

ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY
LEWIS STEPHEN PILCHER, M.D., LL.D.,
OF NEW YORK,

WITH THE COLLABORATION OF

J WILLIAM WHITE, M D., LL D
OF PHILADELPHIA,
Professor of Surgery in the University
of Pennsylvania

SIR WILLIAM MACEWEN, M D, LL D.
OF GLASGOW,
Professor of Surgery in the University
of Glasgow,

SIR W WATSON CHEYNE, C B, F R S,
OF LONDON,
Professor of Surgery in King's College

VOLUME XLVIII
JULY—DECEMBER, 1908

PHILADELPHIA
J. B LIPPINCOTT COMPANY
1908

COPYRIGHT BY
J B LIPPINCOTT COMPANY
1908

CONTRIBUTORS TO VOLUME XLVIII.

- ABBE, ROBERT, M D, of New York, N Y, Surgeon to St Luke's Hospital
- ALDEN, ELIOT, M D, of Los Angeles, Cal, Instructor in Surgical Anatomy in the University of Southern California
- ALEXANDER, SAMUEL, M D, of New York, N Y, Professor of Clinical Surgery, Department of Diseases of the Urinary Organs, Cornell University Medical College, Attending Surgeon to the Bellevue Hospital
- ARMSTRONG, GEORGE E, M D, of Montreal, Canada
- ASHHURST, ASTLEY PASTON COOPER, M D, of Philadelphia, Pa, Surgeon to the Out-patient Department of the Episcopal Hospital
- BABLER, EDMUND A, M D, of St Louis, Mo, Associate Surgeon, St Louis Skin and Cancer Hospital, Assistant in Surgery, Medical Department, Washington University, St Louis
- BARTLETT, WILLARD, M D, of St Louis, Mo, Professor of Experimental Surgery in Washington University
- BASHAM, DAVID WALKER, M D, of Wichita, Kansas
- BEAL, HOWARD W, M D, of Worcester, Mass
- BERG, ALBERT ASHTON, M D, of New York, N Y, Adjunct Surgeon to Mount Sinai Hospital
- BINNIE, JOHN FAIRBAIRN, M D, of Kansas City Mo, Professor of Surgery in the University of Kansas
- BLAKE, JOSEPH A, M D, of New York, N Y, Surgeon to Roosevelt and St Luke's Hospital
- BRANHAM, JOSEPH H, M D, of Baltimore, Md
- BREWER, GEORGE EMERSON, M D, of New York, N Y, Professor of Clinical Surgery in the College of Physicians and Surgeons, Surgeon to the Roosevelt Hospital
- BRINSMADE, WILLIAM BARRETT, M D, of Brooklyn, N Y, Surgeon to the Long Island College and St John's Hospitals
- BRYANT, W SOHIER, M D, of New York, N Y
- COBB, FARRAR, M D, of Boston, Mass, Assistant Visiting Surgeon to the Massachusetts General Hospital
- COLEY, WILLIAM B, M D, of New York, N Y, Surgeon to the General Memorial Hospital, Associate Surgeon to the Hospital for Ruptured and Crippled
- DAVIS, LINCOLN, M D, of Boston, Mass, Surgeon to Out-patients at the Massachusetts General Hospital
- DOWD, CHARLES N, M D, of New York, N Y, Attending Surgeon to the General Memorial Hospital and to St Mary's Free Hospital for Children, Associate in Surgery, College of Physicians and Surgeons

- EISENDRATH, DANIEL N, M D, of Chicago, Ill
 EISING, EUGENE H, M D, of New York, N Y, Adjunct Surgeon, Lebanon Hospital, Assistant Adjunct Surgeon, Mount Sinai Hospital
 ELDER, J M, M D, of Montreal, Canada
- FLINT, CARLTON P, M D, of New York, N Y, Instructor in Surgery, College of Physicians and Surgeons of Columbia University, Assistant Attending Surgeon to the Roosevelt Hospital
 FOWLER, ROYALE HAMILTON, M D, of New York, N Y, Intern at St. Luke's Hospital
- GAGE, HOMER, M D, of Worcester, Mass
 GARDNER, FAXTON E, M D, of New York, N Y
 GARROW, A E, M D, of Montreal, Canada, Assistant Surgeon to the Royal Victoria Hospital
 GILLETTE, WM J, M D, of Toledo, O, Professor of Abdominal and Clinical Surgery in the Toledo Medical College, Surgeon to Robinhood Hospital
 GOODRICH, CHARLES H, M D, of Brooklyn, N Y, Attending Surgeon to the Methodist Episcopal Hospital and to the Brooklyn Orphan Asylum
 GRAY, H TYRRELL, M C, (Cantab), F R C S (Eng), of London, England, Resident Medical Superintendent of Great Ormond Street Hospital for Sick Children
- HABHEGGER, C J, M D, of Watertown, Wis, Attending Surgeon, St Mary's Hospital
 HAGNER, FRANCIS R, M D, of Washington, D C, Professor of Genito-urinary Surgery in the George Washington University
 HALPENNY, J, M D, of Winnipeg, Manitoba, of the Physiological Laboratory, University of Manitoba
 HAMMOND, LEVI J, M D, of Philadelphia, Pa, Surgeon to the Methodist Episcopal and Maternity Hospitals
 HARRIGAN, ANTHONY HART, M D, of New York, N Y, Assistant Surgeon to the Out-patient Department, Harlem Hospital, New York
 HARTWELL, JOHN A, M D, of New York, N Y, Surgeon to Lincoln Hospital, Assistant Surgeon to Bellevue Hospital
 HASBROUCK, EDWIN M, M D, of Washington, D C, Assistant Surgeon to Georgetown University Hospital
 HERZOG, MAXIMILIAN, M D, of Chicago, Ill
 HOTCHKISS, LUCIUS W, M D, of New York, N Y, Surgeon to Bellevue and Junior Surgeon to Roosevelt Hospital, Associate in Clinical Surgery, College of Physicians and Surgeons
 HUBBARD, JOSHUA C, M D, of Boston, Mass, Assistant in Surgery in the Harvard Medical School, Assistant Surgeon to the Boston City Hospital
 HUNTINGTON, THOMAS W, M D, of San Francisco, Cal, Professor of Surgery in the University of California

- JOERG, WOLFGANG, of Brooklyn, N Y
- JOHNSTON, GEORGE BEN, M D, of Richmond, Va, Professor of Abdominal Surgery in the Medical College of Virginia
- JOPSON, JOHN H, M D, of Philadelphia, Pa, Surgeon to the Children's and Presbyterian Hospitals.
- KEENAN, C B, M D, of Montreal, Canada, Assistant Surgeon to the Royal Victoria Hospital
- LANGE, SIDNEY, M D, of Cincinnati, O, Radiographer to the Cincinnati Hospital
- LEE, H M, M D, of New London, Conn
- LEE, W ESTELL, M D, of Philadelphia, Pa, Chief Resident Physician of the Pennsylvania Hospital
- LOBINGIER, ANDREW STEWART, M D, of Los Angeles, Cal
- LUSK, WILLIAM C, M D, of New York, N Y, Assistant Visiting Surgeon to Bellevue and St Vincent's Hospitals, Professor of Clinical Surgery at the New York University and Bellevue Hospital Medical College
- MACCLURE, THEODORE R, M D, of Detroit, Michigan, Surgeon to Solvay General Hospital
- MACLAREN, ARCHIBALD, M D, of St Paul, Minn, Professor of Clinical Surgery in the University of Minnesota
- MASTIN, WILLIAM M, M D, of Mobile, Ala
- MATHEWS, FRANK S, M D, of New York, N Y, Associate Surgeon to St Mary's Free Hospital for Children, Assistant Surgeon to the General Memorial Hospital
- MAYO, CHARLES H, M D, of Rochester, Minn
- MONKS, GEORGE H, M D, of Boston, Mass, Surgeon to the Boston City Hospital
- MORRIS, ROBERT T, M D, New York, N Y, Professor of Surgery at the New York Post-graduate Medical School and Hospital
- MOSCHCOWITZ, ALEXIS V, M D, of New York, N Y, Adjunct Surgeon to Mount Sinai Hospital
- NEWELL, WILLIAM A, M D, of Philadelphia, Pa, Resident Physician to the Episcopal Hospital
- NICHOLSON, CLARENCE M, M D, of St Louis, Mo, Professor of Practice of Surgery and Clinical Surgery, Medical Department, St Louis University
- PATTERSON, FRANCIS DENISON, M D, of Philadelphia, Pa, Surgeon to the Howard Hospital
- PILCHER, JAMES TAFT, M D, of Brooklyn, N Y
- PRICE, JOHN W, JR, M D, of Louisville, Kentucky
- PRINGLE, J HOGARTH, F R C S, of Glasgow, Scotland, Lecturer on Surgery in Queen Margaret College, Surgeon to the Glasgow Royal Infirmary
- RANSOHOFF, JOSEPH LOUIS, M D, F R C S (Eng), of Cincinnati, Ohio, Professor of Surgery in the University of Cincinnati
- ROSS, GEORGE G, M D, of Philadelphia, Pa, Assistant Surgeon to the German Hospital, Surgeon to the Germantown Hospital

- ROYSTER, HUBERT ASHLEY, M D , of Raleigh, N C , Professor of Gynæcology in the Medical Department, University of North Carolina, Surgeon-in-Chief, St Agnes' Hospital
- SCHACHNER, AUGUST, M D , of Louisville, Kentucky
- SCUDDER, CHARLES L , M D , of Boston, Mass , Surgeon to the Massachusetts General Hospital, Lecturer on Surgery in the Harvard University Medical School
- SEELIG, M G , of St. Louis, Mo , Associate Surgeon to the Jewish Hospital, Assistant Professor of Surgical Pathology in the Medical Department of St Louis University
- SHELDON, JOHN G , M D , of Kansas City, Mo
- SPEECE, JOHN, M D , of Philadelphia, Pa , Assistant Demonstrator in Surgery, University of Pennsylvania
- STARR, F N G , M B , of Toronto, Canada, Associate Professor of Clinical Surgery in the University of Toronto, Associate Surgeon to the Hospital for Sick Children, Assistant Surgeon to the Toronto General Hospital
- STETTEN, DEWITT, M D , of New York, N Y , Assistant Visiting Surgeon to the German Hospital
- STONE, HARVEY B , M D , of Charlottesville, Va , Adjunct Professor of Surgery in the University of Virginia
- SWINBURNE, GEORGE KNOWLES, M D , of New York, N Y
- TAYLOR, ALFRED S , of New York, N Y , Visiting Surgeon to Randall's Island Hospital, Assistant Instructor in Operative Surgery at the College of Physicians and Surgeons, New York
- TENNEY, BENJAMIN, M D , of Boston, Mass , Surgeon to the Boston Dispensary, formerly Instructor in Anatomy in the Harvard Medical School
- TURCK, RAYMOND CUSTER, M D , of Jacksonville, Fla
- VAN KAATHOVEN, J J A , M D , of Philadelphia, Pa , Assistant Instructor in Surgery, Instructor in Anæsthesia at the University of Pennsylvania
- WAECHTER, ADOLPH, M D , of New York, N Y , Instructor in Surgery in the New York Post-graduate Medical School
- WAINWRIGHT, JONATHAN M , M D , Surgeon-in-Chief of the Moses Taylor Hospitals, Scranton, Pa , and Buffalo, N Y
- WARREN, J COLLINS, M D , of Boston, Mass
- WHITE, C Y , M D , Pathologist to the Children's and Episcopal Hospitals, Philadelphia, Pa
- WIENER, JOSEPH, M D , of New York, N Y , Adjunct Surgeon to Mt. Sinai Hospital
- WILLIS, MURAT, M D , of Richmond, Va , Adjunct Professor of Abdominal Surgery in the Medical College of Virginia, Junior Surgeon to Memorial Hospital
- WILSON, CUNNINGHAM, M D , of Birmingham, Ala
- WOOD, FRANCIS CARTER, M D , of New York, N Y , Professor of Clinical Pathology in the College of Physicians and Surgeons

ANNALS OF SURGERY

VOL XLVIII

JULY, 1908

No 1

ORIGINAL MEMOIRS.

ANEURYSMORRHAPHY.

TREATMENT OF POPLITEAL ANEURYSM BY THE RECONSTRUCTIVE METHOD[†]

BY JOHN FAIRBAIRN BINNIE, M D,

OF KANSAS CITY, MO,

Professor of Surgery in the University of Kansas

SINCE Matas read his classical paper on endo-aneurysmorrhaphy before the American Surgical Association in 1902, much attention has been devoted to this subject. It is not my intention to make any effort to cover the whole field of the surgery of aneurysm, but I will confine myself to a consideration of the possibility of obliterating the aneurysm and at the same time reconstructing the artery in such fashion that the circulation through it may be restored. For a clear understanding of what may possibly be attained and of what can surely not be attained, it is necessary to refresh our memories as to the common varieties of aneurysm.

I If a small area of a pneumatic tire becomes degenerated the pressure of the air causes a local, more or less spherical, bulging at this spot (Fig 1). If the bulging part is opened we see that it is a sac with a small opening communicating with the interior of the healthy tire (Fig 3). The appearance of the tire and the sac in longitudinal section is

[†]Read before the Section on Surgery, New York Academy of Medicine, March 6, 1908

shown in Fig 2 This corresponds accurately to the ordinary sacculated aneurysm

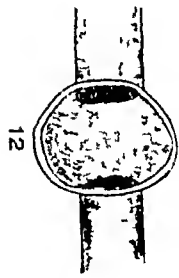
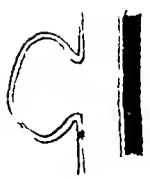
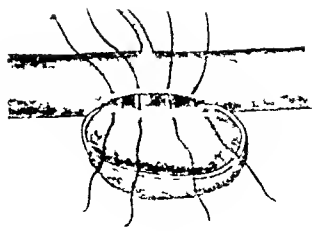
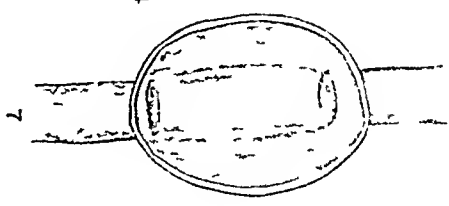
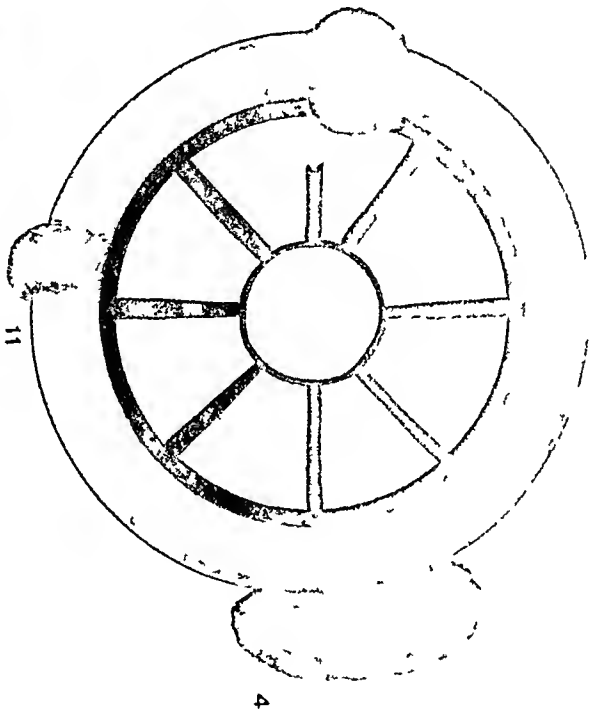
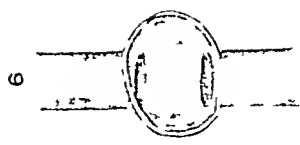
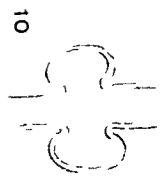
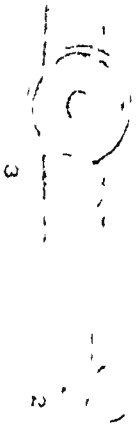
2 If the degenerated area of the tire includes the whole circumference of a limited section of the tire, then the tire endeavors to dilate uniformly, in a fusiform fashion, but is prevented by the felly or solid rim of the wheel (Figs 11, 12, 13) On opening the dilatation we find it is a sac with an opening at each end The sac is *not* a pouch of the tire, it is the tire and its whole wall is degenerated One part of the sac wall is not evidently distended simply because the felly supports it, this gives a superficial and fallacious appearance of pouching The condition corresponds accurately to a fusiform aneurysm which lies against and is supported by bone and can to some extent mimic a sacculated aneurysm

3 The degenerated area includes the whole circumference of a limited section of the tire, but the felly is absent (Figs 8, 9, 10) A fusiform dilatation results and corresponds accurately to a fusiform aneurysm

4 The degenerated area involves considerable of the length, but little of the width of the tire Corresponding to this area there is bulging of the tire (Figs 4, 5, 6, 7) If the sac is opened we see two openings, but these openings are connected one with the other by means of a distinct groove or gutter consisting of sound material The form of defect is identical with that first mentioned except that the connection between the sac and the lumen of the tire itself is a long slit instead of a round hole This corresponds accurately to a sacculated aneurysm, but a sacculated aneurysm which mimics and is often mistaken for a fusiform aneurysm The illustration used by Matas when describing reconstructive endo-aneurysmorrhaphy applied to fusiform aneurysms shows distinctly this type, not the fusiform type, of aneurysm

If a fusiform aneurysm is ever the result of direct injury to the vessel without there being pre-existent disease of the wall, it must be extremely rare To me it seems almost an impossibility

The development of an aneurysm is generally to be re-



ferred to some series of strains acting on a vessel whose strength has been diminished by pre-existing disease. This view is supported by the facts that laboring men are the usual victims and that in about 80 per cent of the cases a history of syphilis is present. Atheroma is commonly and vaguely accused of being the predisposing cause of aneurysm but atheroma is most marked in the aged while aneurysm seems to prefer victims of from 30 to 50 years. If atheroma was the predisposing lesion we would then expect it to be most common in the aged and as atheroma is very wide-spread in its effects on the vessels one would expect multiple aneurysms to be very much more common than they are.

Pierre Delbet notes that while the popliteal artery is a favorite site of aneurysm it is not a common site of atheroma, that plaques of atheroma are rarely found near aneurysms and never in recent aneurysms, that when plaques are found in the sac, they are secondary,—the sac being an old one. He believes with Eppinger that the cause of aneurysm is mechanical injury causing rupture especially of the middle coat.

Malmsten thinks that gummatous degeneration of the middle coat of an artery is the predominant factor in the genesis of aneurysm. Sansom states that an aneurysm may be seen in an otherwise healthy aorta and quotes Sutton as writing, "I have had a sense of awe on looking into the body and seeing that, while all the other organs and tissues were so exceedingly healthy, death had been caused by so limited a disease."

Councilman regards arteriosclerosis as the most common cause of aneurysm; with Thoma, he believes that it is most common in the beginning of the arterial disease when the degeneration of the media is not compensated for by thickening of the intima and when the individual is still capable of severe and sudden muscular exertions which suddenly raise blood pressure and can cause injury to the already weakened intima. These views of Councilman seem to reconcile many conflicting notions.

From the preceding paragraphs it seems that while an

artery as a whole may be diseased and somewhat weakened, yet one limited area thereof is so much more affected either by the disease or by concomitant injury that it gives way while the rest of the vessel remains capable of discharging its functions satisfactorily. If these arguments are in accordance with fact, and for various reasons facts are hard to establish in this disease, then it is reasonable to suppose that if sufficient arterial wall is left to re-establish the arterial tube and this arterial wall, though probably diseased, is not too much degenerated, then it may be possible safely to close with suture the communication between the artery and sac. In the case of a fusiform aneurysm nothing short of excision of the diseased segment of artery and end to end anastomosis of the more or less healthy arterial stump or the implantation of a suitable segment of vein (I am only discussing reconstructive operations) could be of any conceivable value. The reconstructive operation of Matas seems to me out of the question under such circumstances. In a sacculated aneurysm provided that the opening between the vessel and the sac is not too wide, *i e*, provided a sufficient amount of the circumference of the vessel remains sufficiently healthy, then a reconstructive operation may give good hope of success.

I have used the method originally outlined by Matas in two cases. In the first I did not recognize at the time that I was doing a so-called reconstructive operation. I closed the single small opening into the sac with catgut and then obliterated the sac by rows of sutures. (Transactions Am Med Assoc, Section on Surg and Anat, 1904)

The second case was the following

S W K, 67. Seen June 23, 1907. Perfect family history. No syphilis. Three years ago knocked down by automobile the wheels of which passed over left leg just below the knee. Much bruising. Confined to bed one week, crutches two weeks. Apparently absolute recovery.

About three weeks ago stepped into "squirrel hole" with left foot in such a manner as to cause great dorsal flexion of the

foot At this time he felt "something give way in calf" Pain was not severe but swelling soon appeared in popliteal space This swelling increased in size until patient went to bed a week ago

Examination—Heart normal No distinct arteriosclerosis Urine normal Large pulsating tumor at popliteal space No tibial pulse palpable

Diagnosis—Popliteal aneurysm

June 24—Ether Elastic constrictor to thigh Longitudinal incision into tumor revealed a cavity full of soft, black, non-lamellated blood clot Cavity had no distinct walls and was size of two large fists After the clot was removed a ruptured aneurysm as large as a medium-sized orange was found communicating with the cavity through a $\frac{3}{4}$ in opening about $\frac{1}{2}$ in from the remnants of the arterial trunk The walls of the aneurysm were fairly healthy On splitting the true aneurysm sac two arterial openings were found about 1 to $1\frac{1}{2}$ inches apart Fairly healthy arterial wall, consisting of about $\frac{2}{3}$ the circumference of the artery, united the two openings and formed a groove on the bottom of the sac A catheter (Fr 15) was put into the arterial openings and the communication between the artery and sac was closed by iodized catgut sutures, the catheter being removed before the sutures were tightened Obliteration of the sac by means of continuous catgut suture Cigarette drain in the blood cavity first encountered Skin wound closed Dressings applied Limb placed in vertical position Constrictor removed The condition was one of ruptured traumatic aneurysm Owing to the impossibility of obliterating the false aneurysmal cavity, healing was slow but the aneurysm has remained cured

In both cases reported and in a similar one I saw with Dr W J Frick, the result as regards *cure* of the aneurysm, was good, but in none of these cases could it be proved that the circulation was re-established through the vessel Judging from the experiences of Hertzler and others in arterial surgery, the mere fact that catgut, and iodized catgut at that, was used for the closure of the neck of the aneurysms ought to mean that obliteration of the vessels took place and the attempt of *reconstructive* became in fact, successful *obliteration*

tions Each of these cases seemed to me suitable for attempts at reconstruction, but the technic employed outraged every one of the principles elaborated by Carrel and was foredoomed to failure

In a third case I endeavored to utilize the principles of modern arterial surgery

H H G, 40 Colored Barber Smallpox 6 years ago Syphilis 15 years ago, treated for three months Nov 14, 1907 Fourteen weeks ago noticed pain on straightening left leg Twelve weeks ago noticed swelling in left popliteal space which has gradually increased in size Unable to extend knee Pain severe enough to disturb sleep Pain increasing Circumference left leg at upper margin patella 16 inches as compared to 14 on sound side Posterior tibial pulse present left side but weaker than on right Temp 99.8 Pulse 128 Large pulsating popliteal tumor

Diagnosis—Popliteal aneurysm

Nov 15, 1907 Elastic constrictor Longitudinal incision into tumor showed a large, irregular cavity full of clotted blood On removing blood clots a ruptured aneurysm was found containing much fibrinated clot, which was removed The walls of the true aneurysm sac were very ragged and friable On the deep surface of the sac there was an oval opening about $\frac{3}{4}$ to 1 in in longitudinal, and $\frac{3}{8}$ in in transverse diameter This opening formed a trough with three orifices (besides that one leading to the sac). Two of the orifices were the proximal and distal orifices of the popliteal artery, the third and smaller (opposite the hiatus) was evidently a branch

The patent portion of artery was well and gently washed with salt solution and then smeared with vaseline The hiatus was closed as in the Matas operation but vaselined No 1 von Braun's hemp was used as suture material Two rows of these continuous sutures were inserted There was not enough aneurysmal sac of strength sufficient to permit suture obliteration of the sac This was unfortunate as the obliterated sac is a great support to the line of arterial suture It was impossible to obliterate the false aneurysm cavity Elastic constrictor removed No bleeding

The deep wound or cavity was drained and the superficial

PLATE I



Microscopical appearance of section cut through car of *Conium maculatum* L.

wound closed Dressed Leg was elevated The foot was warm and the posterior tibial pulse was perceptible Owing to the fact that a sutured artery was left unsupported, passing through a non-obiterated cavity, an elastic constrictor was arranged round the thigh in such a manner that it could be tightened at a moment's notice

Nov 18 Dressing changed Deep dressing were saturated with blood but were dry Removed drain No discharge No pain Tibial pulse clearly felt

Nov 29 Up till yesterday tibial pulse good Yesterday being Thanksgiving day and the patient feeling well, he celebrating by shaving himself and moving about in bed freely At night he felt considerable pain in the thigh and calf On examination I found a pulsating swelling in the popliteal space, œdema of the leg, *no* tibial pulse, foot warm

Nov 30 Ligation femoral artery at apex of Scarpa's triangle Reopened old wound and drained Dec 31 Has been home for some time and felt well Wound in popliteal space almost closed During last night sudden severe hemorrhage Constrictor applied by patient himself Seen by Dr R M Schauffler who gave him proper emergency treatment This morning reopened popliteal space in which there is a cavity with rigid friable walls The tissues are so friable that local means of permanent hæmostasis are impossible The patient is weak Amputation lower third thigh Recovery

Pathologist's report (DR. F J HALL) —“The specimen consists of a pyriform mass of tissue 14 cm by 8 cm in diameter From apex to base of this mass is found the popliteal artery surrounded by muscle and adipose tissue Throughout much of the tissue are streaks of effused blood and inflammatory induration Toward base of mass is an irregular cavity measuring 5 by 5 cm It is lined by a ragged grayish membrane On one side of the cavity is perceived a round opening communicating with the popliteal artery On one edge of this opening is seen a knotted suture At the bottom of the cavity is a ragged opening that extends through the muscle mass behind On posterior aspect of specimen is found some clotted blood overlying a considerable area of muscle and fat tissue that is thoroughly impregnated with effused blood Section through the artery near the place of rupture shows interior of artery slightly irregular with a definitely thickened wall and surrounded by a mass of hemorrhagic inflammatory tissue

Microscopic examination of section cut through scar of repair of vessel wall—The arterial wall throughout its entire circumference

great distortion and thickening of the different tunics. It is with difficulty that the various coats are distinguished. An irregularly thickened spongy tissue, poor in cells, takes the place of the intima. The lining endothelium is absent. The inner elastic membrane cannot be distinguished. The media shows as a greatly thickened tunic of hyaline connective tissue, in which the fibrillation is all but lost, the individual bundles fusing into one another leaving narrow clefts occupied by slender structureless nuclei. In places the media is penetrated obliquely by small hyaline walled vessels surrounded by round cells and a few polymorphonuclear leucocytes. In several places in the media, the bundles of fibres are separated by an amorphous granular bluish staining material that seems to be a molecular degeneration of an infiltrate similar in all respects to gummatous matter. At one point in the vessel wall is an obliquely placed pathway made as if by cutting instrument. At the point where this enters the lumen of the vessel, is a mass of fused red blood cells and degenerated fibrin threads entangling a few polymorpho- and mononuclear leucocytes. The space between the cut ends of the connective tissue bundles of the vessel walls is occupied by a mass of lumpy structureless pink-staining material, amid which are entangled polymorphonuclear leucocytes, round cells and giant cells of the foreign body type. Immediately adjacent to the walls of this space are a few spindle-cell elements (fibroblasts), and an extremely few new-formed capillaries. At no place do the fibroblasts bridge the gap. As the incision passes out of the vessel into the external coats, many polymorphonuclears are seen held in the meshes of degenerated fibrin and fused red blood cells. Many narrow clefts in the externa in the region of the wound are tightly packed with deeply staining round cells."

In this case the operative technic used differed from Carrel's in that freshly cut arterial wall was not approximated, but two endothelial lined surfaces were brought together as in Dorrance's method of arteriorrhaphy by eversion. The artery as a whole was very seriously diseased. In a weak chain, the weakest link having given way, an attempt was made to so repair it that it should no longer be weaker than the rest of the chain. The result of the operation was a failure, but a failure which came near being a success. The closure persisted for two weeks and then only about one-third of the line of union gave way. The case was most unfavorable, the arterial wall was markedly degenerated, the line of suture was absolutely unsupported by surrounding structures and lay exposed in the cavity of a false aneurysm, and yet apparently success was nearly attained. This failure encourages one to

hope that under more favorable circumstances success may be confidently expected and that perhaps in some cases of sacculated aneurysm of the abdominal aorta it may be possible to open the aneurysm sac, close the opening in the aorta, support the line of suture by obliterating the sac by means of sutures and so make the weakest point in a weak aorta as strong as the rest of the vessel.

ANEURYSMORRHAPHY.

PERSONAL EXPERIENCE WITH THE MODERN METHOD OF TREATING ANEURYSM *

BY ROBERT ABBE, M.D.,

OF NEW YORK,

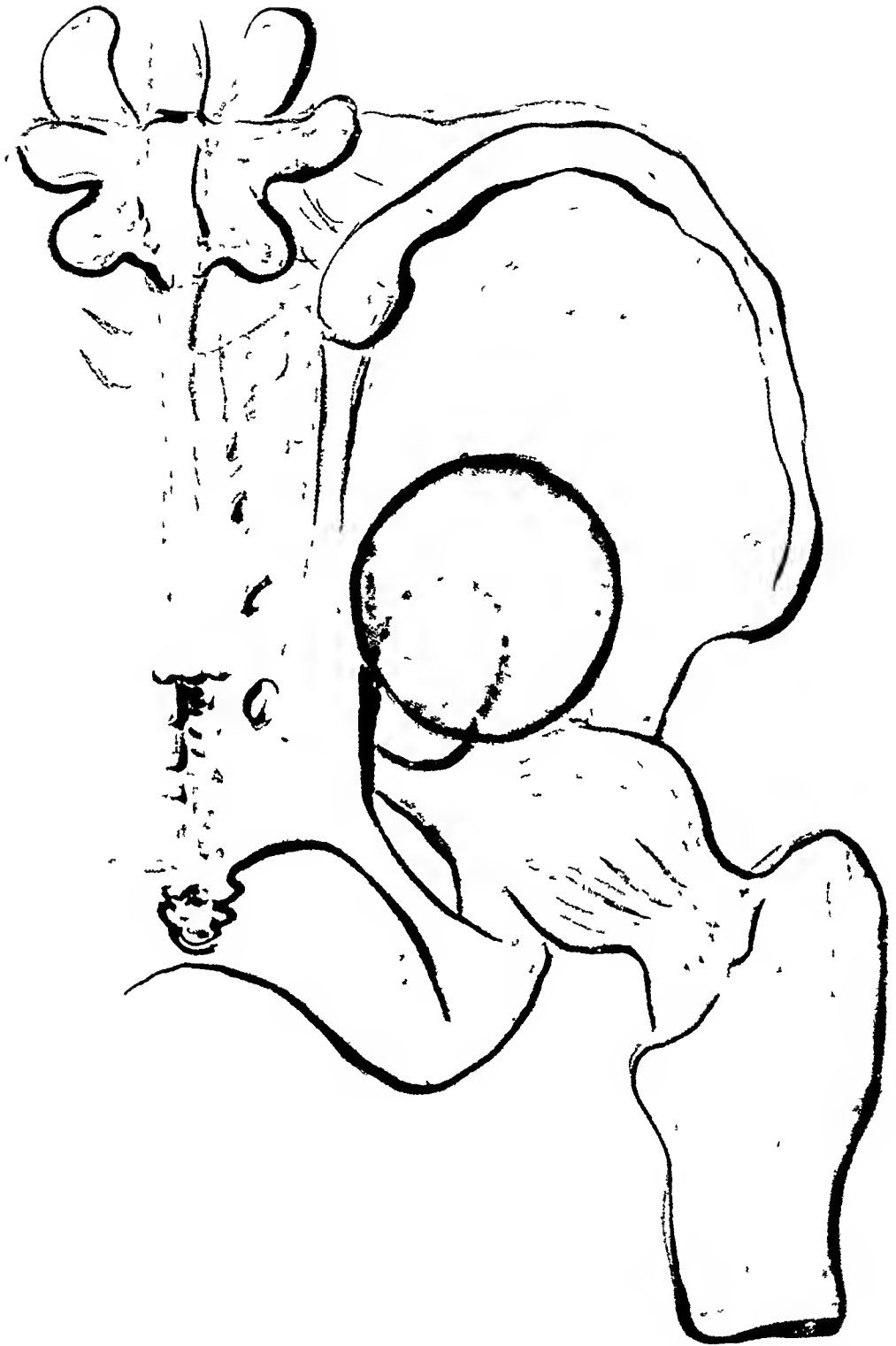
Surgeon to St. Luke's Hospital

THIRTY years ago, it was considered safest to cure an aneurysm by arresting its blood current by digital compression, for a sufficient time to fill it with solid clot. It was common practice for the college professor to call for relays of volunteer medical students, to compress a femoral artery under thumb or finger pressure, for two days or more, until the aneurysm was solidly clotted. My personal experience as a student on two such occasions, gives me a lively remembrance of the tediousness of the method. Ligation by silk in those pre-Listerian days, resulted too often in fatal hemorrhage by ulceration of the vessel. Subsequently, antiseptic ligation held the field almost exclusively. One idea dominated the whole teaching of treatment, namely, the successful filling of the sac by clot, which subsequently "organized" and shrank. By organization was meant fibroid change with slow vascularization extending into the clot.

Ten years later, the theory of thickening and stiffening the resisting wall of the sac, by induced inflammation and cell proliferation was advocated, and its use put to the test in aortic, innominate and other inoperable types of aneurysm. The theory of building up and fortifying the wall from within, soon became accepted as an available method and new hope was excited. In 1886 and '87 the introduction into the sacs, of silver and steel wire, or of silk thread, was advocated, with the double purpose to induce clotting and irritate the sac lining. About the same date, puncture of the wall, by electrolytic needles, using a sharp current to excite inflammation had many

* Read before the Section on Surgery of the New York Academy of Medicine, March 6, 1908

FIG. 1



Aneurysm of the gluteal artery filling the sciatic notch & rare neuralgia from sciatic pressure. Cured by mitis operation

advocates, and considerable success. Even Macewen's later method of scratching the lining with long hatpins, transfixing the sac, was based on the same theory.

Proliferation of the endarterial coats, was the keynote of the success of these methods. I myself had at this time two extremely interesting aneurysms of the aortic arch, into whose sacs I introduced, through a hollow needle, once, a hundred feet of sterile catgut, and again one hundred and fifty feet of fine steel piano wire, exciting its cells by electric contact for an hour (the opposite pole being at the back). Much was gained, as had been in the hands of others, the reports of which I incorporated in a paper (*Med News*, Apr 9, 1887). Some patients so treated survived several months. Autopsy occasionally showed the wire buried in the densely over-grown aneurysmal wall. In Loreta's case, in the abdominal aorta, the sac closed tightly round six feet of silver wire, and in healing, compressed it into a small mass.

Two facts were demonstrated by these valuable contributions to our surgical knowledge of aneurysm. First, that the sac wall, if irritated, can be made the important factor in curing aneurysm, second, that where the tumor is large, the endarterial lining is considerably replaced by cellular tissue and the thinned out lining is too far gone to be available,—failure by such method is sure. In the case of Loreta's aneurysm of the abdominal aorta, there was no dissecting into outside tissues, but it had a complete endarterial lining,—hence fine plastic repair under wire excitation.

This demonstration of the value of the reparative building up of the aneurysm wall, rather than relying on clot filling alone to cure an aneurysm, prepared the surgical world to receive the new method of Dr. Matas.

I was able to employ it first in May, 1905, in a popliteal aneurysm of considerable size, which had been giving much pain from nerve pressure.

It was a simple matter to have the femoral artery compressed during the operation, and then on splitting open the sac, through a vertical skin incision, I found its walls were

eccentric to the artery, strong and continuous on the side toward the joint, but thinned out posteriorly. It was not difficult to place a fine chromicized catgut suture at the open mouth of the artery, and suture the walls together by continuous stitch from above downward, till the sac was entirely closed. One branching vessel opened into its lower half and was included in the suture. The same thread was continued into the overlying fascia and subcutaneous areola layer. A compress dressing without much pressure, gave primary union, and the case was perfectly cured without the slightest peril to the circulation of the foot. Prompt relief of pain followed.

Two things impressed me as especially gratifying. I left the work with no anxiety that I might have cut off a single superfluous drop of blood from the foot, as I might have done had I tied the femoral, and I felt that no recurrent anastomosis by the lower open mouth vessel which I sutured, could continue the dissecting action of the aneurysm. This I had once seen in a similar case after ligation.

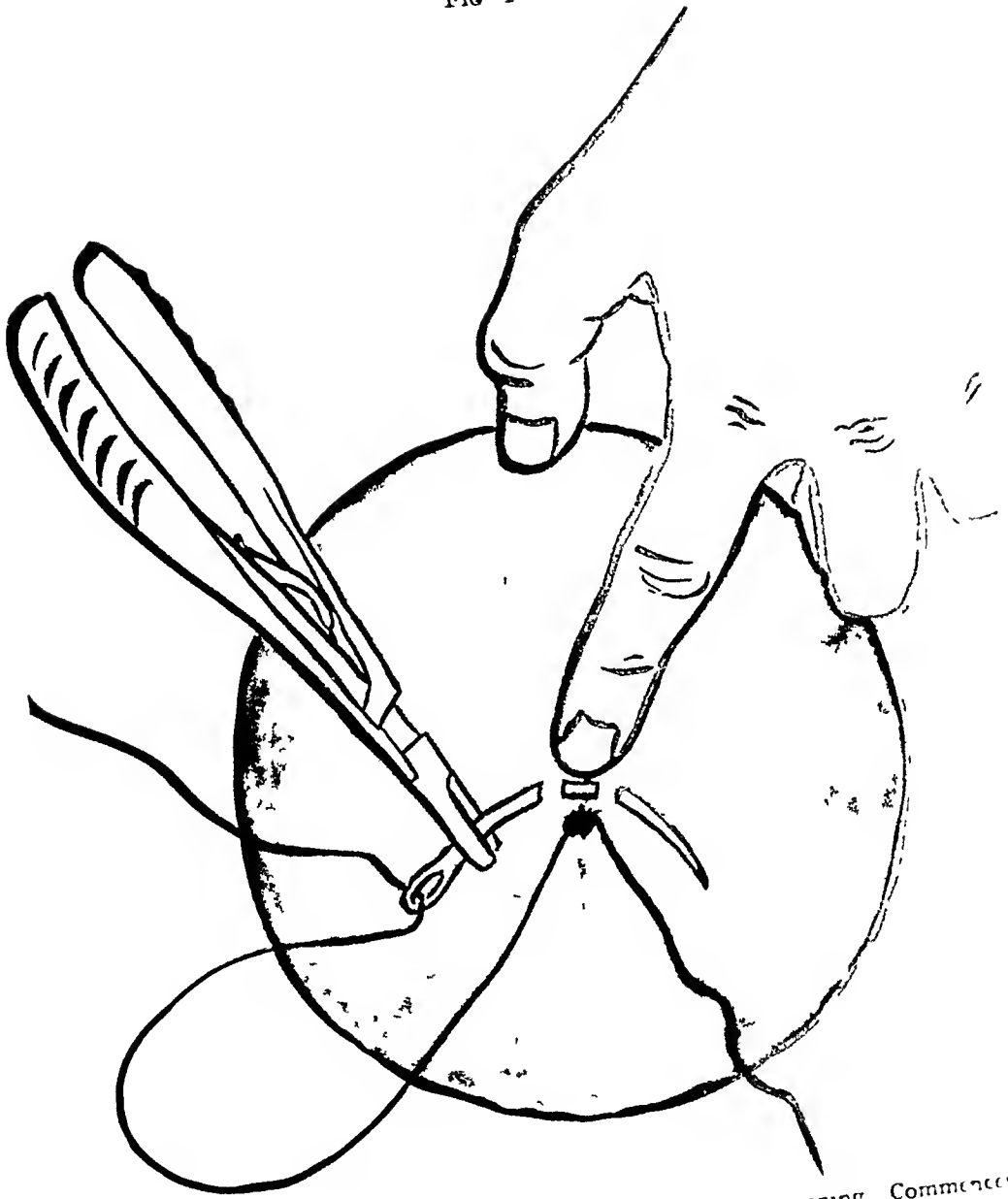
With this experiment I was prepared to apply the method to my second case, where it was peculiarly available.

A young Russian of 24 years had been developing for three months, right sciatic neuralgia with disability in walking, and some swelling of his foot. A pulsating tumor of the right gluteal region prevented his lying on that side also. The man had never had syphilis, but acknowledged gonorrhœa. His heart showed a blowing aortic murmur. Examination showed a spherical, pulsating tumor, three inches in diameter, beneath the gluteus muscle at the sciatic notch, where its pressure had caught the sciatic nerve, and held it tightly against the bone,—hence the neuralgia.

It was a particularly good case for operation by the plastic method, because ligation of the external iliac, while it would temporarily arrest the current, would allow free anastomosis and possible return, meanwhile leaving the distended sac to continue sciatic pressure.

On May 21, 1906, I opened the iliac fossa and threw a temporary silk ligature about the external iliac artery, which was held

FIG 2



Internal aspect of aneurysm finger tip covering pluteal artery opening Commencement of internal occlusive suture

as a loop by my assistant, Dr W S Schley, who drew it up against his index finger-tip, so as to avoid crushing it by tight ligation. This compression at once stopped pulsation in the tumor. I then incised over the tumor, and separated the gluteus. The sac was well distended and easily isolated. Its neck filled the uppermost corner of the sciatic notch (Fig 1). On compression, after the pulsation had been stopped from above, it emptied, and quickly filled again. By inference, this must have been by anastomosis, as this iliac artery was quite occluded by the silk loop.

Seeing no way to keep it entirely empty, I ventured to cut it freely open, and relied on instant internal pressure to stop loss of blood. I first plugged the opening of the gluteal artery with my index finger-tip, and found no other bleeding occurred. I was then able to dry its walls and see that they were firm, with good serous lining. On releasing my finger pressure ever so little, a sharp flow of blood followed, but not in pulsating current. I now began a continuous suture of the internal wall, with fine chromicized catgut, first fixing it by a knot just above my finger-tip (Fig 2). The next stitches were placed so as to catch in the sac wall, on both sides of my finger-tip, which I drew back as I quickly tightened them, thus sealing up the deepest part of the funnel-shaped cavity. After placing the first four deep stitches there was no bleeding, and I leisurely secured one wall against the other by continuous back and forth suturing, with the same thread. I even continued this until I had obliterated the entire sac, and closed the super structures, with no additional knot. The silk thread was removed from the iliac. The wound was bloodless. The patient made an immediate recovery.

Here we have a brilliant illustration of the reliance to be placed on the plastic union of opposing walls of an artery, held in contact, and irritated by the needle puncture and thread. This patient had no recurrence of tumor or sciatic pain up to three months after operation.

The question arises, as to how large an aneurysm we may venture to treat by this method (and how near the aorta). My own conviction is that it may be applied to any artery up to the innominate. If a firm clamp compresses the artery, we will say the subclavian, proximal to the aneurysm, the operator

can leisurely and surely occlude the sac. I can see little difference in the detail from that just narrated, and no reason for failure. I am prepared to go further and say, that if a suitable case of aortic aneurysm in the abdomen presented itself, it would be justified to combine this valuable method with one illustrated by me in 1894 (New York Medical Journal). We then showed the effect of introducing sterile glass tubes, of sizes suitable to the artery, into the lumen of divided vessels, and tying the arterial wall over each end of the tube, the latter being filled with salt solution, just before letting the current resume its course through it. I did this in a cat after cutting the abdominal aorta across, and four months afterward showed a fine healthy, and happy cat on this very platform, with the glass tube healed solidly into her aorta, the plastic exudate buried the tube, and the blood flowed for days through it, until at last the tube excited endarteritis, and occlusion resulted. Meanwhile, collateral circulation had ample time to be established. There seems to be no reason why an aortic aneurysm, below the superior mesenteric, might not be so treated. The current being arrested by strong pressure against the vertebra, the sac might be split, a tube inserted and tied in at either end, and a suture of the aneurysmal wall made tightly about the tube. It is probable that solid closure of the whole track would take place in a week, and occlusion of the aorta above and below be effected, as in my cat, by endarteritis from the presence of the tube. Meanwhile, free anastomosis would surely be established to the lower limbs. That situation is rare for aneurysm, but many cases are recorded, and the aorta has been actually ligated a number of times, in despairing hope of anastomosis, as published by Dr. Keen. The new plastic method may yet triumph.

Surgeons owe Dr. Matas high tribute for perfecting and advocating the technic of his method. The saddest side of this subject is, that, just as we have so promising and scientific a demonstration offered to the world, aneurysms seem to be going out of fashion.

ANEURYSMORRHAPHY.

A CASE OF POPLITEAL ANEURYSM PRESENTING UNUSUAL DIFFICULTIES IN THE APPLICATION OF THE MATAS OPERATION *

BY JOSEPH A. BLAKE, M.D.,

OF NEW YORK,

Surgeon to Roosevelt and to St. Luke's Hospital

W. M., a negro, forty-one years of age, was admitted to Roosevelt Hospital in April, 1905, suffering from a popliteal aneurysm. Its development had been rapid. Five weeks before admission he had noticed pain, a week later a swelling appeared which increased rapidly in size and in two weeks began to pulsate. The stiffness from the swelling and the pain became so marked that he could not walk. There was no history of lues or other etiological factors. Examination revealed a swelling the size of a duck's egg, in the right popliteal space, pushing the hamstring tendons aside. There was visible pulsation and a loud systolic bruit and thrill. There was no other evidence of endarteritis. The second aortic sound was accentuated. The lungs and abdomen were negative.

At the operation hæmostasis was secured by an Esmarch bandage, and an incision four inches long was made directly over the sac and carried down to it. The vein was found flattened over it and was retracted to one side. The sac was then opened for its full length and was found to contain a considerable amount of laminated fibrin. After its interior had been inspected, it was found that the aneurysm was a sacciform one. The communication between the artery and the sac was about one inch long and was situated less than one-half inch to the outer side of the incision in the sac, the artery, therefore, lying on the superficial aspect of the sac. This relation was wholly unsuspected until the sac was opened, there being nothing to indicate it in the appearance of the sac in the bottom of the wound.

Although under ordinary circumstances the case would have

* Read before the Section on Surgery of the New York Academy of Medicine, March 6, 1908

been one admirably fitted for a restorative Matas operation, the propinquity of the incision to the orifice of the sac rendered this procedure impossible. In fact the artery being on the side of the sac toward the operator, rendered the introduction of any sutures exceedingly difficult. However, it was possible to close the communication fairly effectually with a single row of chromicized catgut sutures which, at the same time, considerably narrowed the lumen of the artery. It being impossible to make the suture line more secure, the artery was ligated on the proximal side of the aneurysm. The Esmarch bandage was then removed and the suture line was found to be efficient enough to prevent the reflux from escaping. A few catgut stitches were introduced to obliterate the cavity of the sac and the wound closed without drainage. A moulded plaster splint was applied over the dressing. The stitches were removed on the sixth day, healing occurring per primam. Three months later there was no sign of recurrence.

If one had suspected the relation of the sac to the artery, it might have been possible to have isolated it and rotated it out so as to have made the incision in it opposite its origin. Yet, isolating the sac would have defeated one of the objects for which the Matas operation was devised, namely, the conservation of the tissues and vessels about the sac, which are so apt to be injured in an enucleation. The superficial position of the parent stem made its ligation easy and although it prevented restoration of the vessel, it was analogous to the closure of the opening of the vessel into the sac by suture, as done in the Matas obliterative operation. This case, therefore, may be considered as a partially obliterative and restorative operation, in that the proximal communication with the aneurysm was closed while the continuity of the vessel below that point was restored.

It is a question whether a typical restorative or reconstructive operation is indicated for popliteal aneurysms, since the constant flexing of the joint submits the vessel to much traumatism. It would seem to me that on theoretical grounds the obliterative operation is best. That there is some ground for this opinion is shown by the fact that the only relapses

that have been reported from the Matas operation have followed reconstructive operations upon popliteal aneurysms. The restorative and reconstructive operations are, of course, only feasible in sacciform aneurysms. Even in these it seems to me that the obliterative operation is more conservative, for conditions demanding the preservation of the continuity of the vessel must be rare indeed. The possibility of thrombi, forming after the restorative and reconstructive operations, becoming detached and causing embolism beyond must be borne in mind, although, judging from the reports of cases, this accident does not seem to have happened other than after an obliterative operation. In this instance, gangrene followed an obliterative operation upon a femoral aneurysm, an embolus lodging at the bifurcation of the vessel. The only other reported instances of the occurrence of gangrene also followed the obliterative operation, but were due to injury to the vein and not to the interruption of the artery. There seems to be a general impression, based upon a faulty conception of the principles of the Matas operation, that its main purpose is the conservation of the continuity of the vessel, while in reality it is the least important feature of the technic. This impression is probably due to the natural desire to accomplish the wonderful rather than be satisfied with the more prosaic, although more effectual.

Although my experience has been gained from this one case, and although it was in a way unsatisfactory, I feel that the operation is simple. It is hardly necessary for me to say that it is based upon sound principles and is effectual, for this has already been proven by the brilliant results obtained in the hands of a number of operators, none of them reporting more than a few cases.

THE SEROUS COAT OF BLOOD VESSELS COMPARED WITH THE PERITONEUM.*

BY ROBERT T. MORRIS, M D,

OF NEW YORK.

Professor of Surgery at the New York Post Graduate Medical School and Hospital

It seems to me that the most important part of our new surgical work with blood vessels in general, and much of the old work with aneurysm in particular, depends upon the similarity of the serous coat of blood vessels to the peritoneum. The serous coat of blood vessels, like the peritoneum, throws out plastic lymph promptly for purposes of repair. The surfaces when irritated and brought together have a tendency to adhere, and septic processes in the serous coats of blood vessels give rise to many of the changes which occur in the peritoneum under similar circumstances. If the serous walls of an artery are merely brought together by a ligature, occlusion occurs quite as promptly and more safely than if the ligature is tied so tightly as to cut one or more coats of the artery. Torsion of blood vessels also causes such quick plastic occlusion from the serous surfaces, that arteries of the third class even may frequently be treated in this way, instead of by ligature. The methods of treatment of aneurysm by digital pressure, by the introduction of coils of wire, or by the introduction of electric needles, in the same way lead to rapid exudation of plastic lymph from the serous coats, and this exudation results in causing adhesion of opposed surfaces, or the lymph coagulates from the serous surfaces proceed to engage the coagulates of the blood in the aneurysm in such a way as to cause rapid clot formation.

The new work in the suturing of blood vessels depends for its safety upon the prompt plastic repair of the serous coats. The new work in aneurysm brought forward by Matas gives us a striking object lesson bearing upon this kind of repair.

* Read before the Surgical Section of the New York Academy of Medicine, March 6, 1908

At the same time, may we not take a warning from our experience with the peritoneum? When we first began to appreciate the promptness of repair which was carried on by the peritoneum, it was given an exaggerated value which led to mistakes. In the abdominal incision the peritoneum was sometimes drawn up between the muscular layers of the abdominal wall in such a way as to insure immediate closure of the opening; but with the danger of absorption of the products of plastic exudation in a short time, leaving the muscular and fibrous structures unrepaired, owing to the mechanical obstacle to repair which the surgeon had introduced. In our work with aneurysm, in which the construction of patent channels is contemplated, we must remember this lesson from our experience with the peritoneum. In our suturing of blood vessels generally we must remember that a weak point will be left at the site of the slightest depression of the serous coat, unless the other coats are treated in a way to fortify the weak point. There seems to be no doubt that Ziegler in his text-book on pathology was the first to liken the interior of a blood vessel to that of a serous cavity. The growth of the tunica intima after ligation he compared with the plastic inflammation of a serous membrane. Ballance and Edmunds in their "Ligation in Continuity" 1891, seem to have disputed for the first time the claim that endothelial surfaces unite with difficulty when brought in contact, and they made experiments which showed that most endothelial surfaces adhere with very little provocation. On the other hand, Meigs in his "Human Blood Vessels in Health and Disease" 1907, tends to upset what we are now building upon. He states that there is no endothelial layer which is commonly present in the human arterial system. Perhaps the presence of a fine endothelial layer, or its absence, has no necessary connection with the reparative processes carried on by the tunica intima. Practically, however, we seem to be dealing with an endothelial layer in blood vessels, which acts very much like the endothelial layer of the peritoneum. Delbet in 1906 quotes the experiment of Jensen in 1903, when a steril-

ized piece of catgut, traversing both walls and the lumen of the main carotid, was found after eighteen days to carry no trace of a clot, but that portion of the catgut which was free in the lumen of the artery was swollen at the ends and evidently covered with endothelium

The idea that arteries can be sutured was first conceived by Lembert, about 1750, and Hallowell, under the direction of Lembert, closed a punctured wound of an artery by a winding suture, successfully. In 1772 Assmann made four experiments with winding sutures on the femoral arteries of dogs, and the animals, killed six weeks later, were found to have the arteries obliterated. There was no more vascular suturing done from that time until the development of asepsis, about 1882. Delbet impresses the point that in suture of blood vessels we must remember that everything excepting blood, in contact with the serous coats, is a foreign body, and that the endothelium resents intrusions. He states that the two conditions absolutely necessary for successful work are asepsis and integrity of endothelium. Thrombosis which forms at the site of suture is due to infection. In aseptic work, the ferment thrombin produced by leucocytes and coagulates are not formed. Small wounds in the endothelial coat, and foreign bodies, including toxins, may produce small coagula which tend to enlarge, then to contract, finally to obliterate the blood vessels. The endothelium has a strong tendency to proliferate, but a very little septic infection arrests this proliferation in blood vessels as it does in the peritoneum. The rapid multiplication of endothelium is probably able to arrest coagulation. Delbet in 1889 studied the influence of antiseptic solutions upon peritoneal endothelium and vascular endothelium, and found that the latter was more sensitive than the former. Proliferation was hindered to such an extent that antiseptic solutions were shown to actually prevent healing of arterial wounds. This observation is one of great importance for our consideration in the new work with the arteries. Petit and Jensen demonstrated the harmlessness of aseptic sutures. Etling has never seen any evidence of thrombosis or inflamma-

tion at the site of aseptic tears of the tunica intima, but he has seen proliferation of endothelium at the lower edges of wounds and necrosis at the upper edges, so that in spite of efforts at repair, slight depressions were left. Blood pressure acting upon such slight depressions would have a tendency to develop aneurysm, although Peyton in 1907 sums up the whole subject of aneurysm as a matter of the middle coat alone.

In conclusion, I wish to impress the point that in our new surgical work with blood vessels in general, and with aneurysm in particular, we are to consider the serous coat of blood vessels as acting like the peritoneum, in carrying on immediate repair. We must be even more careful about leaving depressions of the tunica intima without fortification, than we need be in leaving depressions of the peritoneum, for the reason that the blood current will take advantage of such depressions more quickly and more continuously than is done by intra-abdominal organs.

In a case which I reported previously in the *ANNALS OF SURGERY*, temporary cure of a very large popliteal aneurysm was obtained by transforming the sac into a canal similar to the original artery. Recurrence of aneurysm began later at the site of a small depression apparently, and continued to increase from that point, although the greater part of the sutured area remained strong. I mean to suture other large aneurysms,—even of the aorta, if such a case comes for treatment, but the little pit in the tunica intima is the one into which we are likely to fall, in this new sort of work.

LIGATION OF THE LEFT COMMON ILIAC ARTERY.

WITH REPORT OF A RECENT CASE.

BY WM. J. GILLETTE, M D ,

OF TOLEDO, O ,

Professor of Abdominal and Clinical Surgery in the Toledo Medical College,
Surgeon to Robinwood Hospital

So few cases of ligation of the common iliac arteries have been reported that the one here presented seems to me to be of sufficient interest to be placed on record

Prof Z , in April, 1905, was referred to me for examination and advice by Dr W A Dickey, of Toledo, and Dr F M Firmin, of Findlay, Ohio He was 56 years of age, of American birth and had been many years a prominent educator in the State

About seventeen months prior to examination, he had a severe fall, and a short time after noticed a small pulsating tumor in the left buttock, probably arising from the sciatic artery near its exit through the sacro-sciatic foramen It had recently been rapidly increasing in size until the pulsation could be felt over almost the entire buttock Aneurysm was apparently present and operation advised

On April 22nd I operated at Robinwood Hospital The size of the aneurysm was such that successful ligation of the artery above it and below its exit from the pelvis seemed extremely improbable For this reason the abdomen was opened and the left internal iliac artery ligated near its division from the external

The patient made an uneventful recovery Pulsation ceased entirely, and the mass rapidly diminished in size A complete and satisfactory cure was thought to have been accomplished, but seven months later pulsation was again noticed in a small enlargement arising from the former site of the trouble Immediate operation was again advised, but was deferred for nearly three months, when the mass had increased very considerably, but had not reached anything like its former dimensions

On April 18, 1906, at the City Hospital in Findlay, with the assistance of Drs F M Firmin and H L Green, I dissected down to the pulsating tumor in the buttock, thinking to ligate

the artery above it, but the farther I continued the dissection, the larger the sac grew and it was found to be absolutely impossible to ligate healthy artery outside the pelvis, neither was the Matas operation feasible

The abdomen was again opened and compression made on the external iliac, with the idea that the blood supply of the aneurysm might come from some unusual branch of that artery, inasmuch as the internal iliac had already been occluded. A deceptive cessation of pulsation in the aneurysmal sac appeared, and the artery was quickly ligated, but to our amazement on re-examination of the tumor, we found pulsation had not been affected in the least

Nothing was now left to do but ligate the common iliac and this was accomplished with some difficulty. A silk ligature was placed around it and tied close to the bifurcation of the aorta. Pulsation in the tumor now ceased entirely and the abdomen was closed. Through the incision in the buttock first made, the sac was freely opened, a large blood clot turned out, and the collapsed walls tied off at as high a point as possible

Within three days the leg below the knee began to show signs of gangrene which soon fully developed, and on April 24th it was amputated at about the junction of the upper and middle thirds. The flaps promptly sloughed and reamputated, on May 16th, at a point about six inches above the knee. The wound now rapidly healed as did the incision in the buttock

When the abdomen was reopened, incision was made in the line of the old one, to which a portion of the large intestine had become cemented and unfortunately a small opening was made into it. This was closed and no trouble expected from it, but a week later, a nurse, in giving an enema, found water escaping through the abdominal incision, and an annoying fecal fistula developed. This soon closed spontaneously

Recovery, though slow, was complete, and in September the patient resumed his arduous duties as Superintendent of the public schools of a large city

A résumé of the literature of ligation of the common iliac artery shows that this operation has been very infrequently performed, and that the death rate following it has been and is yet, very high, also that gangrene of the leg is of frequent occurrence, and beyond the power of the surgeon to prevent

Carl Dreist of Strassburg, in 1903, published a paper in the *Ztschr für Chir*, compiling all the cases found in the literature up to that time. In reporting these cases he adopted the classification of Kummel, placing them under four heads, first, those that were performed only for the purpose of checking hemorrhages, second, to cure aneurysms of large vessels, third, to devastate vascular pulsating tumors; and fourth, to prevent bleeding during extirpation of tumors or exarticulation of the femur.

He found that fifty-nine cases had been operated prior to 1880, or in the pre-antiseptic era; and since then, until 1903, he was able to find reports of nineteen more.

In addition to the cases reported by Dreist, in a search which I had made in the Surgeon General's office at Washington, I have been able to add one more which was reported in the *British Medical Journal* in 1903, pages 77 and 78, by Arthur H. Martin, in which a private in the late Boer war received a bullet-wound in the left groin and an aneurysm of the left iliac artery developed, for which ligation of this artery was done with recovery.

A summary of the cases reported, including my own, would show that the iliac arteries have been ligated all told eighty times, with fifty-six deaths, or a death rate of 70 per cent over all, that fifty-nine of these operations were done prior to 1880, during the pre-antiseptic era, with forty-six deaths, or a death rate of 77.97 per cent, and that in the twenty-one operations done since 1880, presumably with aseptic precautions, there were ten deaths, which shows a reduction in the death rate to 47.64 per cent, a very decided improvement. Gangrene of the leg has occurred in the last twenty-one cases seven times, or in $33\frac{1}{3}$ per cent. In the fifty-nine cases prior to 1880, the same number, seven, with six deaths were reported. This is probably an error, for no doubt there were many more.

Dreist says very truly that although the death rate has been lowered in later times by aseptic methods, the operation is still a dangerous procedure, and should only be employed in the presence of the gravest necessity.

THE QUESTION OF OPERATION FOR NON-PENETRATING INTRACRANIAL TRAUMA.

BY JOHN A. HARTWELL, M D,

OF NEW YORK,

Surgeon to Lincoln Hospital, Assistant Surgeon to Bellevue Hospital

NON-PENETRATING injuries of the cranial contents may be divided into four classes in their consideration from a therapeutical standpoint First—Those in which the injury is so slight that recovery is certain without operation Second—Those in which the severity of the injury is so great that death is inevitable in a short time Third—Those in which the injury is of such a nature that operation is positively indicated And fourth—Those in which the indications for and against operation are more or less evenly balanced, the border-line cases The first and second classes need but a brief consideration In the first are included cases of mild or moderate concussion without gross anatomical lesions The diagnosis of this condition usually offers no especial difficulty As a rule, the inflicting violence is not very great The patient loses, to a greater or less extent, consciousness; the face is pale, there is vomiting, muscular relaxation, including the sphincters, and a loss of tone in the blood vessels, causing sweating and feeble rapid pulse The reflexes are usually at first diminished, and then exaggerated The pupils are, as a rule, dilated The respirations are shallow and rapid The temperature is not elevated, and may be lower than normal The course of the condition is toward recovery, and in a short time, with rest in bed, the administration of stimulating enemata, cardiac restoratives, and external heat, a marked improvement is noted It must be remembered that this picture of concussion may be present as a complication in any brain injury, and may mask the symptoms of a more serious lesion The more severe cases

* Read at a meeting of the New York Surgical Society, Feb 26 1907

of concussion belong to class four, and will be considered there

Under the second class belong those cases in which the damage to the brain is very extensive, or implicates the centres of the vital functions in the medulla. Extensive damage (of this sort) results usually from multiple fractures with large intracranial hemorrhage and laceration of brain tissue. The latter are occasionally seen without fracture. A localized injury involving only the medulla is, fortunately, rare, for death is almost instantaneous. The patients of this class present such a varied symptomatology, and their condition is one of such extreme shock, that no accurate diagnosis can be made. Death usually ensues within a few hours, and no treatment is indicated, other than the means usually employed to combat the shock. This, however, should be done energetically and consistently, because it occasionally happens, that the brain damage is not so great as the shock indicates, and recovery is possible.

The class of cases in which operation is plainly indicated, and that class where its value is doubtful, are of especial interest. In deciding for operative interference in any case of intracranial injury, certain well founded principles have been formulated in the past, and our present knowledge in no way alters them. First—An accurate diagnosis of the pathological lesion existing must be possible. Second—The possibility of relieving this condition must be present. Third—The operative violence in accomplishing this must not be excessive. And fourth—It must be reasonably certain that complete recovery will not take place without operation.

Cerebral localization has made great advances through the work of the physiologists, neurologists and pathologists during the last decade, and accurate diagnosis is accordingly advanced. In dealing with a trauma, however, considerations arise which are not present in brain tumor and abscess, namely those due to the general concussion and to the possibility of multiple brain injuries being present. For these reasons, the advances in localization are not of so great value in working

out the problems presented by our subject, as they are in a more circumscribed pathological lesion

A careful analysis of all non-penetrating intracranial injuries shows that only two sub-groups can be properly made under classification three, where operation is positively indicated. The first of these is when the brain injury is due to a direct damage to the brain by a depressed fracture, and the second, the classical middle meningeal hemorrhage, or hemorrhage from a cerebral vessel directly affecting a sensorimotor area. In the first sub-group the procedure of dealing with the fracture and the underlying brain injury is well established along definite lines, and needs no elaboration at this time. Emphasis must, however, be laid on the necessity of exploring every suspected fracture of the calvarium, even though no evidence of actual brain injury is present, for such injury may exist in the absence of symptoms and late epilepsy often supervenes on such a condition.

The clinical picture in the second sub-group is usually well defined, and rarely is a diagnosis not made. The history of the injury, followed, usually though not invariably, by longer or shorter periods of concussion, then freedom from symptoms, with the later onset of compression, muscular contraction and paresis on the opposite side, are too well known to require any comment. Operative interference in all cases of these sub-groups is positively indicated. The following case of Dr. Gallaudet, by whose courtesy I include it, is an excellent illustration.

CASE I—Admitted to Bellevue Hospital on November 27, 1907, in the service of Dr. Gallaudet, with the history of having received a fist blow over the left side of the head the day before. He was not rendered unconscious, but almost immediately became aphasic. On admission he was aphasic, and showed a right-sided paralysis of the arm and face. Operation showed a stellate fracture with extra and subdural hemorrhage, as well as hemorrhage in the brain cortex over the area indicated by the symptoms. Recovery.¹

¹For a full report of this case by Dr. Gallaudet, see page 122

The following cases, however, show the difficulties which may arise, and the caution which is needed in drawing conclusions

CASE II—*Trauma over left parietal region from falling timber Subdural hemorrhage over right precentral convolution with late development of irritation and pressure symptoms Operation with recovery.*

A man, aged 49 years, colored, was admitted to Lincoln Hospital on Feb 27, 1906, with the following history: 'On Feb 21st he was struck on the head by a large piece of timber falling from a height of one or two stories. He was knocked to the ground, was picked up unconscious and taken to a hospital in an ambulance. He regained consciousness in about twenty minutes, but was excitable and irritable. There was a large scalp wound over the left parieto-temporal region. This was sutured. He continued in his irritable and rather unmanageable condition during the next six days, without, however, manifesting any local cerebral symptoms. In addition to his irritability, he had several attacks of vomiting. He was taken home against advice. On his admission to Lincoln Hospital, six days after the injury, the following notes were made: Patient has a healed scar on the left side of his head, six inches long and curved like an operative incision. Patient seems drowsy, yet at intervals he is irritable, restless and unmanageable, trying to get out of bed. Patient does not respond to questions, and on being aroused looks at one with a vacant expression. Heart, lungs and abdomen all normal. Extremities no change in sensations apparent. No paresis or paralysis. Reflexes markedly increased. Control of bladder and rectum perfect. No change in pupils. Shortly after admission patient had a convulsion, which was reported by the attendant to be general in character.

During the following three days the convulsions were repeated several times, were of very short duration, and no evidence that they were at all localized could be obtained. On March 2nd these convulsions began to occur with great frequency, about every twenty minutes, for periods of an hour at a time, followed by a period of rest. They were becoming longer in duration, and the following notes on their character were then made. There was a vacant staring expression of the eyes, with a gradual conjugate deviation toward the left, after four or five seconds, there was a tonic contraction of the muscles of the left side of the face,

then a drawing of the head downward on the left shoulder, with an elevation of the latter, then tonic contractions in the arm, and then in the leg of the left side. This phase occupied about fifteen seconds, and was followed by clonic spasms of the same parts and in the same order. The whole convulsion lasted from sixty to ninety seconds, during which time the patient was totally unconscious. He then gradually regained consciousness and the contractions ceased. At this time, when he had altogether about twelve convulsions, he for the first time showed a decided left facial paralysis, and marked weakness of left arm and leg. This was on the ninth day after the injury, the first convulsion having been noted on the seventh. On the eighth day his condition had apparently improved. Operation was performed on March 2nd, nine days after the injury, and as soon as the localized character of the convulsion and the paralysis was evident. Under ether, a curved incision was made just above the right temporal ridge, about eight inches in length, and carried directly down to the skull, the flap being turned downward. The fissure of Rolando was now marked out, and a trephine opening was made over the face centre, in ascending frontal convolution, and enlarged upward with the rongeur, to an area of about two inches in diameter. The dura showed no pulsation, and a clot could be seen beneath it. Dura was divided around the line of the bone opening, and a large organized clot was removed from the cerebral cortex. Electrodes applied to the facial centre produced a prompt contraction of the muscles of the face on the left side. No response could be obtained in either of the extremities, possibly because the nerve cells here were too much damaged, and inspection indicated that the cells for the arm were more damaged than those for the face. The opening in the skull was not extensive enough to reach the leg centre. The dura mater was closed with catgut sutures, a small rubber tissue drain put down through it, and the scalp sutured back in place. It was noted that the scalp was quite œdematous, probably due to lymphangitis following the original scalp wound.

Post-operative notes. March 4th—Recovered from anæsthetic without incident. Slightly excited during first twelve hours and then became rational, but continues rather stuporous. Can be roused and gives correct account of injury and other details of his residence, work, etc. Still has considerable weakness of

left upper extremity, and less of the lower extremity Is able to make coordinated movements Slight spasticity of left lower extremity, none of upper Left-sided facial paralysis, and left deviation of tongue Upper branch of facial less paralyzed than lower Examination of reflexes unsatisfactory No oculo-motor paralysis March 6th—Patient less rational than formerly More stuporous Complains of pressure on head Very restless Left arm can be moved only with great difficulty Face more markedly paralyzed Wound examined and pus found along the suture line Considerable distension Opened after stitches were removed Infection all through the scalp, due to previous lymphangitis Pus infiltrating tissues down to the dura Dura thickened, and brain apparently well walled off by dense adhesions Wound area opened up widely and dressed with free drainage and bichloride solution March 9th—Wound very much cleaner Both sides granulating well In centre, still suppurating Left arm can be moved more freely March 11th—Wound granulating well Patient more rational Movements on left side stronger March 13th—Patient improves slowly Mind brighter Movements of left side gradually returning Can put left hand to mouth and nose with effort Cannot hold up a single finger of his left hand March 15th—Wound granulating well Pulsations fair Complains of being in bed Left facial paralysis less marked Can nearly hold up finger of left hand March 27th—Wound granulating well, nearly free from pus Mental condition practically normal Left leg can be used nearly as well as the right Left arm not so powerful as right Power of coordinated movements not entirely regained With eyes closed, fingers do not meet by several inches Left not so strong as right Facial paralysis still slightly present on left side of face Left eye cannot be shut tight Left angle of mouth can be drawn back but a very little April 10th—Patient discharged, forty days after the operation Wounds entirely closed Still showed slight incoordination of left side of body, and slight left-sided facial paralysis He walks without any dragging of the foot Mentally, he is normal

April 25th—Eight weeks after his operation there was absolutely no evidence of his injury remaining except the scars on his head, and the brain pulsation beneath the opening in the skull There is no evidence of any irritability of the brain due to adher-

ent dura The patient was again seen on February 10th, 1908 The only evidence of his trouble is found in a loss of general strength and an irritability of temper No paralysis or convulsions have developed

The interesting point here was the late onset of localizing symptoms He had been under observation in two hospitals for nine days, before any evidence on which to base an accurate diagnosis was available And yet at operation a subdural hemorrhage was found directly over the motor area, on the side opposite to the injury A case reported by Dr Krauss, *Amer Journal Medical Science*, Vol 128, is the almost exact counterpart of this

CASE III—*Trauma over right parietal region from falling brick Paralysis on right side Operation on left side Extra and subdural hemorrhage over right motor area Death*

Man, age about 30 years, was admitted to Lincoln Hospital May 19, 1906, with a history of having been struck on the right side of the head by a falling brick Patient was rendered entirely unconscious and remained so on his arrival at the hospital in the ambulance Examination at that time showed the following conditions Patient entirely unconscious Cannot be aroused Pupils equally dilated Do not react to light No strabismus No facial paralysis Hematoma on right side of head over the posterior frontal area Suggestion of a depressed fracture of the skull, but not definitely determined No laceration of scalp No bleeding from ears, nose, or mouth Spine apparently intact Chest normal Pulse very slow, though regular Second sound of the heart good Pulse shows slight increase in tension. Lungs normal Breathing varies At times, Cheyne-Stokes in character, at other times it became stertorous Abdomen normal All superficial reflexes are delayed, though present Knee-jerks present but not exaggerated Cremasterics delayed All extremities moved normally though hard to elicit on account of unconscious state Sensations delayed but present One hour later an incision $2\frac{1}{2}$ inches long was made on the right side of the head, through hematoma down to the skull No fracture discovered over the parietal bone anywhere on the right side as far as felt One hour later, patient still entirely unconscious Color good Pulse slow but of good volume Slight increase in tension Breathing more regular and deep Pupils left slightly contracted, reacts to light, right dilated and does not react *Right cyclid*

partially paralysed with a tendency to right facial paralysis Irritation with pin causes no response on right side On left side of face causes shutting of eyelids and twitching *Right arm and leg partially paralysed*, though not entirely so Some response to pin Toes moved some Knee-jerks absent on right side Very slight on left Cremasteries delayed on right side Present on left

Three hours later Patient entirely unconscious Supra-orbital pressure causes facial movement on the *left side* Only slight on *the right* Pupils right dilated, left contracted Neither reacts to light No strabismus No nystagmus Pin pricking on whole of left side, including face and extremities, causes active movements on that side Right side pricking causes movements of left extremities, with evidence of sensations but feeble movements of right arm, face, and lower extremity, those of the right thigh being a little stronger than those of the leg Right knee-jerk exaggerated Superficial reflexes of right side about normal Knee-jerk of left side about normal Superficial reflexes on left exaggerated While eliciting cremasteric reflexes, patient voided urine and was apparently conscious of the act Pulse still slow Respirations labored and stertorous. Five hours after the injury patient was etherized Head cleansed on table and a curved incision was made over left temporal region about in line with the temporal ridge Incision down through all tissues to bony skull Flap raised intact, and bleeding vessels caught and clamped Flap turned down and covered with hot towel Surface of skull exposed over left motor area (previous to incision by mensuration the motor area of left hemisphere was determined and the skull marked for arm area) Skull trephined The dura appeared dark, but seemed to pulsate With continuous saline irrigations trephine opening was then enlarged up and down, and to both sides, exposing an area about $1\frac{1}{2}$ inches wide and 2 inches long Dura rather dark, but brain pulsating Large congested vessels in the dura Incision longitudinal in character made through the dura and enlarged with scissors Vessels of the pia mater exposed, greatly congested No subdural hemorrhage Brain tissue itself rather darker than normal, and under severe pressure About the margins of the opening, brain appears better and more normal in color Crucial incision now made in the dura, and brain allowed to bulge out fully half an inch

Immediately, patient's breathing, which had been labored and stertorous previously, became quieter and deeper. Pulse found now to be increased in frequency, and more nearly normal rate. Character of brain area exposed, changed when left to bulge for a time. Central area in opening has several dark spots, as if intracerebral hemorrhage had taken place. Surface about margins became nearly normal in character. Bulging seemed to relieve some of the intracranial pressure. Puncture made through pia mater, but no fluid obtained. Slight venous oozing followed. Cerebral puncture disclosed no deep hemorrhage. Flap brought back, and with dura left open the entire tissues of the scalp were sewed back in place with continuous catgut suture. Rubber tissue drains inserted, and sterile dressing applied. Patient returned to ward and put in bed with head raised. Patient passed comfortable night. Still unconscious, though not deeply so. Breathing quietly. Pulse a little rapid. Slight movement present in right arm. Left hand had to be tied to keep him from tearing off dressing. Face flushed. Urine passed involuntarily in the bed. Slept part of the night.

May 20th—9 30 A M Patient seems somewhat conscious. When name is spoken at times opens one eye and appears to hear and understand. 2 P M Face flushed. Breathing quietly. Pulse good with less tension. General condition remarkably good. Right pupil dilated, left contracted. Both react to light, though right, very little and slowly. Motor system same as yesterday previous to operation. Left side moved normally. Right leg, thigh and toes all moved slightly, thigh the most. The only difference is in the upper extremity, which seems more paralyzed than yesterday. To stimulation, only movement of arm elicited. Forearm and hand completely paralyzed. Right eyelid and face moved more than yesterday, though still somewhat paralyzed. Sensory, same response as yesterday. Heat, cold and pain tried. Apparently not so sensitive to heat and cold on left side as to pain. Right side not distinguishable. Right knee-jerk exaggerated. Left normal. Cremasterics, right not obtained, left normal. Superficial abdominal delayed on right, exaggerated on left. Bowels have not moved as yet. Active incontinence of urine. Mental condition improved. Patient seems to know his name and resists when catheterized. When pricked with pin, seizes hand pricking him with his left hand and mutters inco-

herently May 22nd—General condition not so good Mentally, more deeply unconscious Left pupil dilated and does not react Entirely paralyzed on right side No response to pin pricks Right knee-jerk slightly exaggerated, but not markedly so At times has to be catheterized, at others has active incontinence. Deep pricking on right side of body and extremities produces movements of the other side of body Not quite as marked as when the same prick is applied to left side Knee-jerk right side lost Cremasteric present Left pupil reacts Right pupil reacts slowly Right axillary temperature 102.2 F Left axillary temperature 102.6 F May 23rd—Patient responds to name, and when asked questions mutters incoherently, though he seems to hear and partly understand Paralysis on right side total Sensation on right side dulled Pin pricks cause very little movement on the opposite side Left side sensations less marked Left pupil contracted and reacts Right dilated, and it also responds slowly Patient breathes rather heavily and seems comatose most of the time Urine passed involuntarily Bowels have moved only with enemas Sphincter control seems perfect Reflexes right knee-jerk lost, left present Cremasterics present These findings remained unchanged until death on May 25th

Autopsy—On removing skull-cap considerable amount of extradural soft jelly-like blood clot was found over the *right motor* area and temporosphenoidal lobe None on the left side On opening dura an extensive clot was found covering the lower half of the right ascending frontal convolution extending forward toward the frontal lobes Just above Sylvian fissure, in front of Rolandic area, the clot was rather firm and the brain surface showed considerable pressure damage Over operative wound, brain seemed entirely normal Whole left motor area was entirely free from clot or evidence of injury, either extra or intradural A small hemorrhage was found deep in the brain at the site of one of the needle punctures No fracture of the skull found Examination of the medulla showed a normal crossing of the pyramids

This case illustrates a condition not infrequently observed, namely, the brain injury on the same side as the paralysis Three explanations are given first—a rare condition of uncrossed pyramids, second—a counter pressure on the opposite side from the hemorrhage against the bony wall, producing local-

ized pressure there which is not felt immediately beneath the soft cushion of the blood, and third—an error in observation, that is, the voluntary paralysis exists on the side which is moved when irritated, the movement being reflex, whereas, on the non-paralyzed side, no movement takes place, because the reflexes are inhibited by the normal cerebral influence. The latter seems the more plausible, though in this case the movements appeared to be voluntary in character. After the operation, his efforts to remove the dressings certainly could not be called reflex, and they were made powerfully with the left arm—that is, on the side where the brain damage was subsequently found—so that the arm had to be tied to the bed. Whatever the explanation is, the therapeutic procedure should be to open both sides of the skull in such cases. The neglect to do so here probably cost the patient his life. The muscular reflexes, as usually elicited, it will be noted, varied from time to time, sometimes being greater on the right side, and sometimes on the left. The variations in the pupil, too, were irregular and not to be classified, though as a rule they were of the Hutchinson type described below. These curious variations in reflexes are those reported by all observers, and emphasize the fact that clinically the teaching of physiology concerning the reflexes is of little value. Their confused condition in spinal injury has been the subject of much unsatisfactory study. This case is very instructive when considered in conjunction with Case II. The injuries were very similar in their nature, but the results were quite divergent. In Case II the hemorrhage was only subdural on the side opposite to the injury, and the paralysis was contralateral to the hemorrhage and slow in developing. In Case III the hemorrhage was both extra and subdural on the side of the injury, and there was a homolateral paralysis developing early. The late development in Case II seems to have been due to a chemical destruction of nerve cells by the changes in the blood clot, while the early development in Case III was undoubtedly due to the immediate effects of the pressure.

Loeb has shown that the cerebral cortex is not excited by the ordinary chemical stimuli which affect nerve fibres. This does not preclude the possibility, however, of a stimulation due to a change in the cells themselves when subject to a condition such as that found in Case II. No recent hemorrhage was present, and the pressure per se did not seem sufficient to cause the symp-

toms observed Some of the cells, too, seemed inexcitable to faradism, which still further points to serious damage in their structure having taken place

CASE IV—*History of old trauma over left side of forehead Symptoms of late abscess over left motor area Operation without finding lesion Death Autopsy showed no brain lesion, but a condition of the kidneys suggesting acute uræmia as cause of symptoms and death*

Man, age 28, admitted to Lincoln Hospital April 6, 1907, in an unconscious state, the following history being obtained from his family Three years previously the patient was struck on the left side of forehead Was unconscious from the blow for over twenty minutes Recovered in a short time with seemingly no ill effects About six months ago patient suddenly had trouble with his speech Was unable to speak for a time Attack similar to "petit mal" Would be all right the next day Since that time he has never been quite the same Speech thick and hard to understand After succeeding attacks he seemed to become depressed in spirit, and at times acted as if he were drunk or drugged About two months ago he was treated at this hospital for injury to left foot, from stone falling on it, causing a bursting laceration on the sole Wound cleaned, drained and sutured Healed up very rapidly At this time he was considered mentally weak He was brought to the hospital in an ambulance yesterday, while in an unconscious condition, and having convulsions, general in character According to his wife, who found him in this condition, he had never had any attacks of this kind before

Examination showed the patient to be well nourished He was entirely unconscious, lying in bed with head turned to the left, eyes also drawn to the left Pupils equal, regular, reacting to light Eyes oscillate slightly and at times slight incoordination is seen There is constant twitching of right hand, particularly middle fingers Also twitching at times of right side of face, right leg, and whole right side of body When twitching is most marked, left leg becomes involved The temperature ranges from 100 to 103.5 Pulse 110 Respiration 25 to 30 Leucocytes 20,000 There was no paralysis noted, though the right extremities seemed weaker than the left The picture here given is that of a late abscess following a trauma, and the great-

est point of irritation seems to be over the motor area for the face and arm in the left hemisphere. The conjugate deviation of the eyes is away from the side on which the extremities are involved, and not toward it, as is the rule. One discrepancy is noted. After twenty-four hours' observation, operation was advised and accepted.

Operation, April 6th—The motor area of left hemisphere was determined, and the skull marked for arm area. A horseshoe shaped incision was made through all the tissues down to the skull, over left motor area, flap being turned down and protected by a hot towel. Skull trephined and opening enlarged with rongeur. Dura appeared normal through opening about $1\frac{1}{2}$ inches wide and 2 inches long. Incision made in dura exposing cerebrum, just anterior to fissure of Rolando. Brain pulsating normally, no bulging, vessels in pia seemed enlarged, but membranes about them appeared abnormal, some places being pearly white, but mostly yellow. These areas small and opaque. The exposed area of brain was then thoroughly explored with needle in search of abscess, but with no result. Dura closed with catgut sutures. Flap sewed back in place with interrupted and continuous catgut sutures. Dressing applied. *April 7th*—Patient still in unconscious condition. Seemingly a little brighter. Pupils equal, dilated. Some drooping of left eyelid. Slight nystagmus. Eyes still drawn to left side. Pupils react to light, but sluggishly. Marked flattening of right side of face. Right arm flaccid with some twitching of hand, but not so continuous. Left arm rigid. No reaction to sensation or pain on either side. Right leg flaccid, purpuric condition on leg extending from ankle to upper third of thigh. No reaction to pain or sensation. Knee-jerk increased. Babinski present. Left leg rigid. Knee-jerk normal. No Babinski. Cremasteric reflexes absent on right side, present on left. Abdominal reflexes active. Dermographia all over body, marked on abdomen. *April 8th*—Patient had a general convulsion. Twitching in hand not present. Condition worse. Rise of temperature to 103.5 . Very rapid small pulse. Breathing irregular. Has to be fed by catheter through the nose, and per rectum. Urine and feces lost in bed. *April 9th*—During a convulsion this morning, eyes were first noticed becoming incoordinated and drawn to right side, then twitching seen on right side of face, tetanic movements rapidly increasing, then extending to fingers

of right hand and arm, next the right leg was involved, then becoming general. Attack lasted about two minutes, dying out where it began. No increase in knee-jerk on right side. No Babinski. Death sixty hours after operation, with no change in condition last noted.

Autopsy—The brain exposure was found to be exactly over the face and arm area. Nothing abnormal was found on the surface, either in the dura or the brain itself. Sections showed no abnormality other than those due to the needle puncture. At the end of one of these $1\frac{1}{2}$ inches from the surface, beneath the arm area, there was a clot about $\frac{3}{8}$ inch in diameter. Other smaller clots were also found. This is interesting as explaining in part the greater degree of paralysis after the operation. The kidneys showed a condition of acute degeneration which the pathologist reported to be due to a toxemia of some sort. There was no evidence of any chronic lesion. The possibility of the convulsions being uræmic, cannot be excluded, though previous to operation, and following it, urine was freely excreted. It contained considerable albumin and some blood, particularly just prior to death, but this was believed to have been due to his toxic condition. All the other organs were found normal, and no additional cause of death could be determined.

It is well known that uræmia may cause one-sided convulsions simulating a brain irritation. In this case, however, the history of the old head injury, the weakness on the convulsed side and the elevated temperature, with the leucocyte increase, all seemed to justify the suspicion of brain abscess.

CASE V—Unconscious alcoholic patient with head contusions. Convulsions on left side. Operation and death. Autopsy showed localized cortical softennings.

Unknown man, age about 45 years, admitted to Bellevue Hospital September 27, 1906, from Harlem Hospital with a diagnosis of alcoholism. He was in coma most of the time, but soon after his admission it was noticed that he was having frequent general convulsions, one every hour or so. On Sept 29th the convulsions became localized to the entire left side of body, each one lasting from one half to two minutes. In the intervals the left side seemed to be paralyzed. Complete examination at this time showed the man to be partially conscious, but unable to answer questions. He showed every evidence of

being markedly alcoholic. Supraorbital stimulation brought on convulsions of the left side of the body, eyes deviating to the right, pupils are equal and moderately dilated, and react normally. Pulse regular, fair force, moderate tension. Knee-jerks absent on both sides. Left upper and lower extremities paralyzed. Right extremities both moved voluntarily. No paralysis of face, but some convulsive twitching on both sides.

Examination of head shows general contusions and bruises over face and forehead. The case was considered one of probable alcoholic cerebral oedema, but the presence of contusions on the head, and the localized nature of the convulsions and paralysis, led me to operate rather against my judgment. Accordingly the motor area was exposed over the left hemisphere, and the brain found to be in a congested condition, and somewhat oedematous, but no localized process to account for the left-sided convulsions. Following the operation, the patient's condition was practically unchanged, and he died about two hours later.

Autopsy—The brain was found to be markedly oedematous, with areas of circumscribed softening scattered irregularly over the cortex. This condition was especially marked in the first temporosphenoidal convolution on the right side, and in the angular convolution, both of which are situated well behind and inferior to the motor areas. Operation in this case was done on insufficient data. The element of an alcoholic cerebral oedema, with the localized softening, was given too little weight.

A summary of these four cases shows, one with distinct local hemorrhage over a motor area, giving no symptoms until the ninth day, and three with all the symptoms of a localized motor lesion, in which, at operation and autopsy, no such lesion could be demonstrated. Nothing could better illustrate the difficulties encountered in making an accurate diagnosis in these conditions, and the necessity of being cautious in deciding for operation.

There is left for our consideration the fourth group of our classification, the true border-line cases, and this constitutes one presenting even greater difficulties. A study of the manifold functions of the brain, its liability to serious injury despite its complete protection in the skull, its inaccessibility to the surgeon, and its delicate structures, reveals at once the cause of these difficulties. The cases coming under this group may be conveniently divided pathologically as follows. First—Serious con-

cussion Second—Contusion, that is, multiple small lacerations of brain tissue and blood vessels Third—A more extensive laceration confined to a limited area Fourth—Hemorrhage not giving distinctly localized symptoms, that is, not causing irritation or compression over an area of known and demonstrable function Fifth—A combination of two or more of the above in the first sub-group, serious concussions, a careful study of the symptomatology will usually be rewarded by a correct diagnosis There is, almost without exception, a history of an injury acting rather diffusely over the head, followed by immediate unconsciousness Vomiting is present, but not of the projectile type seen in compression The whole appearance is one of extreme shock, or collapse, except that the pulse, while soft and compressible to the vanishing point, is not always correspondingly accelerated This condition lasts a varying time, and is *usually* followed by slow improvement, if the result of a pure concussion, without gross lesions Occasionally, however, instead of recovery a new set of symptoms is ushered in The picture then is more complex, and with the symptoms described above, there are mingled those of cerebral excitation These are restlessness, irritability and increased reflexes The patient resents markedly any attempt at an examination Instead of improvement, he passes from this stage into one of deepening coma, and the slow, full high tension pulse, and slow deep respirations mark the onset of a condition of compression This may, of course, be due to a hemorrhage, but it also develops without this when the disturbed tone of the blood and lymph vessels allows the transudation of serum to produce a brain oedema The following case fully illustrates these points

CASE VI—*Diffuse head trauma Concussion with later onset of cerebral irritation symptoms and compression Decompression operation Recovery*

A boy, ten years old, was admitted to Lincoln Hospital February 4th, 1906, at 2 P M with the history of having fallen a distance of 20 or 30 feet, and landing on his head and shoulders No one actually saw him fall, so that it was impossible to get accurate data on the above points He was brought to the hospital by ambulance in a condition of considerable shock, and partial coma He could be aroused with difficulty, surface cold and pale, temperature 99.2, pulse 120 and weak, respiration 32 There was

no paralysis Pupils were dilated No localizing symptoms of any sort could be made out Examination of the head showed an extensive hematoma over vertex and left parieto-frontal region No evidence of fracture could be made out under this hematoma There was no bleeding from the ears, mouth or nose, nor any subconjunctival hemorrhage

The child was put to bed, and the usual remedies for shock, including rectal irrigations and morphine, were given In the course of an hour the shock had considerably lessened, and the coma was less deep He continued to recover from the shock, but the coma again deepened, and the irritability on being aroused was becoming excessive No coordinated response could be elicited in any way He resented very markedly any manipulations, or any effort to make him answer questions He failed to recognize his father All the reflexes were markedly exaggerated, but no paralysis or anesthesia could be made out His condition was diagnosed as one of severe cerebral concussion, with progressive changes in the cerebral vessels, and beginning oedema of the brain Under ether anesthesia, two hours and a half after admission, incisions were made over the hematoma, and the skull explored No evidence of fracture could be found It was determined to open the skull for the purpose of exploration and decompression Accordingly, the temporal muscle on the left side was exposed along its origin, its fascia turned back by a semilunar incision, and the fibres separated vertically, according to the method advocated by Cushing A one-inch trephine opening was then made at a point one and one-half inches above, and one inch in front of the external auditory meatus, exposing the dura This was seen to be dark in color, very tense and without pulsation No extra dural hemorrhage was found The skull was rongeuired away in all directions, making an opening of about $2\frac{1}{2}$ inches in a longitudinal by 2 inches in a vertical diameter The same condition of the dura was present in the whole area A small opening was then made in the dura, and the blood-tinged cerebrospinal fluid spurted out to a distance of about 3 or 4 inches, thus showing the pressure under which it existed The dura was then cut away over the whole surface from which the bone had been removed, exposing the brain beneath The brain did not pulsate The small superficial blood vessels were dilated to three or four times their natural size, and the blood in them was of a dark, venous color.

There was no actual trauma of either the vessels or the brain tissue itself apparent

In the course of three or four minutes the pulsation in the brain gradually returned, the blood vessels became much less prominent, and the blood in them became of an arterial color. Coincident with these changes, the condition of the patient's pulse and respiration was closely watched, but it could not be determined that any change took place, the pulse rate remaining from 110 to 120. The temporal muscle, which had been retracted antero-posteriorly during the manipulations in the skull and brain, was now allowed to fall together again and was tacked with three or four catgut sutures. The temporal fascia and skin were carefully sutured along the curved section with catgut, a small drain being left down to the brain tissue. A copious dry dressing was applied to the wound. The child recovered from his anesthesia without incident, and in the course of three or four hours was entirely conscious with practically no symptoms of cerebral irritation. He gave the details of his injury, and told his name and address. His convalescence was uneventful, the wound healed per primam, and the pulsation beneath the temporal covering of the brain has been present ever since. There is no tendency for any increase in the size of the cerebral protrusion, but on the other hand, a decrease. Immediately after the operation, and during the following days, it was as much as one-half to three-quarters of an inch above the skull level. It has gradually lessened, until now its maximum is only one-quarter of an inch, and palpation shows it to be less tense than it was two weeks ago. It would have been better to have made an osteoplastic flap, but no instrument for this was at hand, excepting the gouge and mallet, which, under the existing conditions, would have been exceedingly dangerous from the continued jarring necessitated. An attempt to leave the dura in situ and resuture it failed because of the great tension, and the subsequent gradual subsidence of this tension shows that a replacement of this dense membrane would have continued to an excessive intracranial compression, and defeated the very object of the operation. The uncovered brain is a "silent area" and it may be hoped that the pericranium will develop enough thickness and firmness to protect it.

The conditions which determined operation on this boy were, rapidly increasing coma and cerebral excitability, with the strong

belief by those observing him, that he was developing the very condition found, namely, cerebral œdema, due to changes in the blood vessels, which would inevitably prove fatal if not relieved. The absence of localizing symptoms left no other course than to produce a decompression of the brain, and thus combat the increasing compression due to loss of tone in the cerebral vessels.

Subsequent note, Feb 10th, 1908—The protrusion of the brain has entirely subsided, and given place to a depression one-half inch below the scalp, that is, to its normal level. Except for the skull opening it is entirely normal. The satisfactory result here obtained by no means warrants the conclusion that such lesions invariably produce a picture so easily interpreted. It was the apparent hopelessness of not operating, that acted as the determining factor in deciding for operation.

Cannon and Cushing have studied this condition and both come to the conclusion that an œdema of the brain may arise in this way, through osmotic forces, sufficient to give pressure symptoms by driving out the blood from the medullary centres. In this particular case, this phase had just been reached, and it was apparently rapidly increasing.

CASE VII—Diffuse trauma of head. Symptoms of marked cerebral irritation and compression after three hours. More marked over right precentral area. No improvement for three days. Decompressing operation over right motor area. No localized lesion of any moment. Prompt improvement and ultimate recovery.

A woman, age 28 years, fell from a street car on Aug 24, 1907, striking her head on the pavement. She apparently received no severe injury and walked home. When seen by the ambulance surgeon shortly after, she was quite rational and apparently not much hurt. She refused to go to the hospital. Three hours later the ambulance was again called, and she was brought to the hospital, where examination showed the following condition. Patient lies on right side with knees drawn up. Arms folded across the chest. There is an apparent condition of chilliness, and the bed clothes are drawn up beneath the chin. She assumes above attitude whenever moved. Eyes are closed, breathing natural and she appears in natural sleep unless disturbed. She resents any interference, resisting more or less violently. She moves all extremities freely. Left arm decidedly weaker than right, also left leg

weaker than right Irritation about the head makes apparent a paralysis of lower left facial branches Pulse 56, hypertension Left knee-jerk increased No ankle clonus Superficial reflexes unsatisfactory Left pupil reacts to light normally Right also Pupils equal, and normal in size Left eye fixed in external strabismus Right eye moves on irritation Palpation of skull shows profuse hematoma all over calvarium, but more on right than left side For the following three days there was no marked change in any direction, though the slight left-sided paralysis seemed to be somewhat decreased On Aug 27th, operation was decided upon because of the signs of continued cerebral pressure as seen in the slow pulse, the irritable condition and the tendency to coma when left undisturbed

Operation—Skin incision over right Rolandic area after fissures had been mapped out on the skull No fractures present Trephine opening made and enlarged with ronguers Brain showed increased intracranial pressure, but pulsated slightly Opening of dura showed slight trace of dark colored blood clot Reaction with a battery showed that left face area was exposed Dura sutured with catgut Rubber tissue drain Skin flap sutured with interrupted silk sutures Dressing applied Patient returned to bed in fair condition with head elevated

Post-operative notes, Aug 28th—The general condition is about the same, but the pulse has risen to 70 and 80, whereas before it ranged from 50 to 60 as the highest Aug 28th—The general condition shows improvement, the irritability having almost disappeared The subsequent course was toward uneventful recovery and by the end of the week the patient was in a normal condition, and the wound was entirely healed Undoubtedly this case would have recovered without operation The recovery would have, however, been slower, and there was present a very good chance of later manifestations, the "cerebrasthenia" of Bailey, developing

A decompressing operation as practised in these two instances therefore seems justifiable in the border-line cases, where no localizing diagnosis can be made As already pointed out, the same group of symptoms may arise from such divergent causes, and the pathological conditions present be so complex, including all the grades above enumerated under

class four, that their relief is problematical. The abdominal surgeon is often confronted with the impossibility of making a diagnosis in obscure lesions, but he has the advantage of being able to deal with whatever may be found on direct inspection of the organs. The brain surgeon cannot do this, and therefore an accurate diagnosis before operation is imperatively demanded despite the difficulties. The deductions to be drawn from these considerations are apparent. Every available point must be weighed in making a diagnosis and a prognosis.

The diagnostic data may be grouped as follows. First—those of the functional disturbance of the brain as a whole. Second—those of the actual damage of brain tissue over local areas. Third—those of the derangement of function due to lesions outside of the brain. Fourth—manifestations of injury shown in organs other than the sensorimotor system. The confusing symptoms falling under the first group are usually present to a greater or less degree, that is, concussion masks and distorts other symptomatic findings. The pupils, for example, may be equally dilated, or one may be inactive while the other may be normal. Statistics should theoretically throw some light on the location of a lesion producing such changes, but a study of the various authorities, and one's own experience, give such divergent results, that little value can be placed on them. Hutchinson has pointed out that the rule is to find the pupil on the injured side dilated, due to a paralysis of the third nerve or its connections. This is more applicable to basal hemorrhage with fracture of the base, however, or with a low hemorrhage from the middle meningeal artery. The explanation of the many exceptions is probably found in the complicating disturbance of function as a whole. The other reflexes are also of uncertain value, and for the same reason. The study of the second group, namely, diagnostic data derived from damage to brain tissue over a localized area, holds out more promise. But even here, casual observation is very deceptive, and only a most rigid analysis of each symptom can lead to any safe conclusion.

Cases II to V illustrate the difficulties encountered here. Sensory motor paralyses are practically the only guides of importance, because the interpretation of pure sensation by patients suffering from head injury is often unobtainable at all, and is always confused. Valuable diagnostic information may be obtained by the presence of symptoms due to associated injuries outside the brain. Of these, the presence of a fracture of the skull is of especial significance, and if the fracture exists on the vertex the associated injury is often easily determined by inspection at this point. On the other hand, fracture at the base of the skull gives no pathognomonic signs other than those of the fracture itself. The bleeding from the nose and ears or the escape of cerebral fluid, and the subconjunctival ecchymosis, are of no value in determining the damage to the nervous structures. Occasionally the paralysis of a cranial nerve at its exit from the skull is present, and thus the line of fracture may be determined but without additional information along the lines under consideration. Anatomical considerations may lead to the satisfactory localization of a compressing hemorrhage in such cases, and Cushing earnestly advocates a low exploration in these cases for the purpose, first, of removing what clot can be reached, and second, to give relief to compression by opening the skull. This procedure seems founded on sound principles of brain surgery, and certainly is worthy of wider application than it has had in the past. Under the fourth diagnostic grouping, that is, findings outside of the brain, there are four of value. First—that resulting from a tapping of the spinal cord. Second—a protrusion of the eyeballs. Third—the condition of the choked disc due to increased intracranial pressure. Fourth—the changes in the circulation and respiration due to interference with their medullary centres. The presence of blood in the spinal fluid is often the only diagnostic proof that the brain, or at least the dura, has suffered gross damage. This blood can have two sources, one from ventricular hemorrhage, and the other from subdural hemorrhage. Hemorrhage within the brain tissue does not give it. Fracture of the base usually does

From this sign we may correctly infer a lesion other than severe concussion when this question is in doubt. The protrusion of the eyeball also shows increased intracranial pressure and is absent in concussion alone. The same is true of the choked disc, which is more marked on the side of greater pressure. This sign is of the utmost importance and often turns the scale in making the diagnosis of a compression being present. Cushing has shown that it is a very delicate sign and changes rapidly with the change in pressure.

The changes in the circulation and the respiration are equally important. Every operating room where brain surgery is done should be equipped with the means of accurate determination of these functions. The rate and force of the pulse are most important guides. A slow rate with marked variations during short intervals is significant of various stimulation with a tendency toward paralysis of that centre. Many observers have found the change in blood pressure to be in direct relation to the change in intracranial pressure, but Cushing was the first in this country to emphasize that the rise in the former was a conservative act to keep up the circulation through the compressed centres. He reports a case where the blood pressure rose above 300 mm. of mercury, with a prompt fall when the intracranial pressure was released.

Eyster has worked out the changes in respiration. He showed that the arrhythmic respiration is due to an alternate anæmia and vascularization of the centre with the failure or success of the blood pressure to keep up with the intracranial pressure. He also showed that the irritability of the respiratory centre is lost from anæmia sooner than the other centres. A rising blood pressure, with arrhythmic respirations, therefore betokens the last stage of compression as given by Kocher. Hence, a close watch on these functions is most important for diagnosis and prognosis.

From the above outline of the complicated conditions found in brain trauma, one must conclude that it is among the most difficult pathological conditions the surgeon is called on to treat. But few words are needed to consider the opera-

tive procedure to be followed, once operation has been decided upon. Practically all parts of the skull, except the base and the lower occipital region, may now be opened by means of the osteoplastic flap. It is outside the scope of the present paper to discuss the technique and the details of this method in its manifold applications. It may, however, be said that the use of the trephine and the rongeur has largely been discarded for one form or another of the electrically run burr and saw, and that with the latter, very large areas of the brain may be exposed with the minimum of shock and damage to the skull. We may even indulge in the hope that the future will see still further improvements in these implements, to such an extent that the exploratory surgery of the brain may be more rational and less hap-hazard than it has been in the past. It is safe to say, that along these lines lies the development of a technique which will yield results far more favorable than any heretofore seen.

The seven cases here reported have been selected as illustrations of groups three and four of the original classification, adapted for the therapeutical consideration of intracranial lesions. Case I is a typical example of the definitely localized lesion, giving almost unmistakable symptoms. Case II shows a similar lesion, but with somewhat modified symptoms. Cases III, IV and V illustrate the sources of error where the clinical picture simulates a definitely localized lesion, but where no such lesion exists. Cases VI and VII were selected as examples of the fourth group or the border-line cases. In neither could a localized lesion be diagnosed, nor was one found at operation. Yet the general picture seemed to justify something being done to relieve cerebral irritation and pressure. The decompressing operation fulfilled these indications, and proved of value in both cases.

A critical analysis of the subject as illustrated in the seven cases warrants the following conclusions. First—In but rare cases, namely, those of isolated injury affecting the sensorimotor area, can a positive focal diagnosis be made. Second—All grades of brain injury may be found in different

parts of the same brain Third—A general concussion may be followed by secondary changes in the circulation which, if not relieved, produce pressure and death Fourth—A pure decompressing operation is indicated in two conditions (*a*) for the relief of pressure due to inaccessible hemorrhage, and (*b*) to relieve the pressure arising from traumatic œdema of the brain Fifth—Operation done without a very definite object in view, which object is based on careful diagnosis, is apt to be more harmful than helpful Sixth—the whole subject is fraught with manifold difficulties and the brain surgeon should strive to become a practical neurologist in organic lesions

SPLENECTOMY.

REPORT OF SIX CASES, TOGETHER WITH A STATISTICAL SUMMARY OF ALL THE
REPORTED OPERATIONS UP TO THE YEAR 1908*

BY GEORGE BEN JOHNSTON, M D,

OF RICHMOND, VA,

Professor of Abdominal Surgery in the Medical College of Virginia

SPLENECTOMY, or the operation of removal of the spleen, may be indicated either because of pathological changes or injuries and wounds affecting that organ

The physiology of the spleen presents many difficult problems for solution, but the classic experiments of Bardeleben, in 1841, showed that the spleen might be removed in healthy animals and be followed by no serious loss to the animal economy The knowledge of this fact soon led to the performance of this operation in the case of human beings who presented evidence of disease or injury of the spleen

The close relationship existing between the spleen and the blood-forming organs would lead one to suppose that its extirpation would be followed by pronounced alterations in the blood and lymphatic glands It has been found that slight changes do occur but of an apparently insignificant character Vulpius, who first made this feature the subject of experimental study, concludes as follows

1 Extirpation of the spleen produces a transitory decrease in the number of red, and an increase in the number of white, corpuscles

2 The thyroid gland cannot vicariously assume the function of the spleen

3 The lymphatic glands and the bone marrow show an increased blood-forming activity after removal of the spleen

4 The regeneration of the blood, after loss of blood, is

* Read before the Johns Hopkins Medical Society, Baltimore, Md, March 2, 1908

probably less rapid in individuals in whom splenectomy has been performed

It has been observed that some patients complain of pain in the bones after operation which has been attributed to increased medullary activity. In some few cases the thyroid gland has apparently hypertrophied, associated with symptoms of increased thyroid function. It has been suggested,—and experimental work to some extent corroborates this,—that an animal deprived of its spleen becomes more liable to infection by any pyogenic bacteria.

Extirpation of the spleen in human beings has been done for various conditions by a number of operators and we may conclude that splenectomy is a justifiable operation in certain cases. The operation, however, is a serious one and is attended with a high mortality. The chief inherent dangers are hemorrhage and shock, but there are many additional factors which have to be considered, such as the size of the tumor, the presence of adhesions, and other concomitant conditions. A correct knowledge of the disease process is most essential, and this has to do particularly with the question whether the lesion in the spleen is a primary affection, or a part of a more generalized process.

In order to speak with some degree of understanding on these points I have summarized the contents of an exhaustive monograph by Bessel-Hagen, in which all the recorded cases of splenectomy prior to 1900 are tabulated, and to these I have added an analysis of all the subsequent operations to the first of January, 1908. In this way I have collected in all 708 cases of splenectomy, including six cases of my own. The mortality in the whole series is 27.4 per cent, while that of the 8 years from 1900 to 1907, inclusive, is 18.5 per cent. The exact value to be placed on a statistical inquiry of the kind I have undertaken is difficult to estimate. The most noticeable thing is that a very large proportion of these 708 cases are reports of single cases by different operators. This fact has a bearing in two directions. In the first place it may be supposed that only successful cases are reported, while on

the other hand one's skill in performing an operation is largely dependent upon one's experience with it. With these appreciations of the possible fallacy in the deductions I will proceed to discuss the different lesions of the spleen that may, or may not, be treated by splenectomy, and the results of the operation up to the present time.

Bessel-Hagen,²⁶ in 1900, compiled 360 cases of splenectomy, exclusive of cases of partial splenectomy. Of these, 222 cases recovered and 138 were fatal, a mortality of 38.3 per cent. In his tabulation, however, he includes only 335 cases with 212 recoveries and 123 deaths, as he chose to omit certain cases in which he believes the value of splenectomy was biased by co-existing conditions. In the accompanying table I have attempted to include all the recorded operations of splenectomy up to January 1, 1908, but have been able to find only 353 cases reported prior to 1900.

Idiopathic Hypertrophy of the Spleen—Chronic tumor of the spleen, in certain instances, may be justly attributed to one of several causes, to be found either in a primary condition of the spleen, or as a part of a constitutional dyscrasia. Quite apart from these factors, however, not a few cases of chronic splenic enlargement exist in which the clinical history and all the concomitant conditions throw absolutely no light on the origin of the tumor. Nor are the pathologists prepared to classify these enlarged spleens except under the general term of chronic indurative splenitis. It seems most probable, however, that the inception of the process is to be sought in some past infectious disease. Not a few cases are undoubtedly due to a latent malarial infection, as splenomegaly is very common in individuals who reside in or emigrate to malarial regions, who give no history of chills and fever. Other possible causes are to be sought in chronic infectious diseases, such as congenital and acquired syphilis, rickets, scrofulosis, scurvy, etc., and as a sequel to acute hyperplastic splenitis from various causes. Is it not possible that some general infections may occur in which the spleen may bear the brunt of the attack without other general manifestations? One well recognized

SPLENECTOMY STATISTICAL SUMMARY

Disease or Lesion	Bussel Hagen to 1900			Johnston, 1900-1908			Total to 1908		
	Cases	Re- covered	Died	Cases	Re- covered	Died	Cases	Re- covered	Died
Idiopathic hypertrophy	33	20	13	41	33	8	71	53	21
Idiopathic hypertrophy, ectopic spleen	45	40	5	15	14	1	60	51	6
Idiopathic hypertrophy, twisted pedicle	16	8	8	11	11	0	27	19	8
Malarial hypertrophy	88	58	30	61	53	8	149	111	36
Malarial hypertrophy, ectopic spleen	26	25	1	14	14	0	40	39	1
Malarial hypertrophy, twisted pedicle	5	3	2	7	7	0	12	10	2
Splenic anaemia	17	12	5	44	37	7	61	49	12
Cysts, hydatid	15	11	4	8	8	0	23	19	4
Cysts, non-parasitic	7	7	0	12	12	0	19	19	0
Leukaemia	42	4	38	7	2	5	49	6	43
Tuberculosis of spleen	4	3	1	6	5	1	10	8	2
Sarcoma of spleen	9	6	3	3	3	0	12	9	3
Abscess of spleen	7	7	0	2	1	1	9	8	1
Miscellaneous affections	2	1	1	11	10	1	13	11	2
Wounds and injuries	37	20	17	113	79	34	150	99	51
Totals	353	225	128	355	289	66	708	514	194
Per cent.		63.7	36.3		81.5	18.5		72.6	27.4

cause is found in all conditions of congestion or stasis, such as an obliterative phlebitis of the splenic vein, and particularly chronic occlusion of the portal vein with associated cirrhosis of the liver

The indications for the removal of the idioopathically enlarged spleen are not at all absolute. It is principally justified as a prophylactic measure, as an otherwise trivial traumatism may seriously jeopardize the patient's life by the susceptibility of the enlarged spleen to rupture. The mortality depends directly upon two factors—the size of the spleen, and the skill and experience of the operator.

Prior to 1890 splenectomy was performed for idiopathic hypertrophy 18 times with 7 recoveries and 11 deaths, from 1890 to 1900, 15 cases were treated by splenectomy with 13 recoveries and 2 deaths, from 1900 to 1908 I have collected 41 splenectomies with 33 recoveries and 8 deaths (see bibliography). This gives a total of 74 splenectomies with a mortality of 28.3 per cent.

Ectopic Spleen with Idiopathic Hypertrophy—By far the most common cause of displaced, or wandering, spleen is an enlargement of that organ which induces a relaxation of its suspensory apparatus. In rare instances an ectopic spleen may be a congenital anomaly, as in a case cited by Moynihan in which a boy twelve years old had a spleen so mobile that it would lie in the left iliac fossa. The only other condition in which a spleen of normal size is found displaced is in connection with a general visceroptosis, as in Glenard's disease.

The indications for splenectomy in cases of ectopic hypertrophied spleen are usually definite. A patient with a large floating spleen is always in jeopardy from the possible occurrence of torsion of the pedicle. In not a few cases distinct subjective symptoms are found to be due to a displaced spleen, as it may exert pressure on, or become attached to, various organs in the abdominal cavity. A rather frequent situation is in the pelvis, where it may become adherent to the uterus, as in one of my cases, so as to simulate a subserous fibroid.

In some cases intestinal obstruction has been caused by the pressure of a wandering spleen

The statistics of splenectomy for ectopic hypertrophied spleen show 17 operations prior to 1890 with 14 recoveries and 3 deaths, from 1890 to 1900, 28 splenectomies were done with 26 recoveries and 2 deaths. Since 1900 I have been able to find reports of only 14 cases with 13 recoveries and 1 death, as follows: Bland-Sutton²⁷, Bryson³⁰, Haeckel³⁶; Lucy¹⁴⁹; Schon²¹⁷, K. Schwarz²¹⁸; Silvestri²²³, Ashby,⁹ large ectopic spleen complicated by typhoid fever, Llobet,¹⁴⁷ displaced hypertrophic spleen with primary carcinoma of pedicle, Tridondani,²⁴⁷ very large ectopic spleen in a pregnant woman, delivery followed by splenectomy, Power,¹⁹¹ large ectopic spleen due to a blow received $3\frac{1}{2}$ years prior to operation, and three instances of pelvic displacement of spleen for which splenectomy was done by Cestan,⁴⁹ Peterson,¹⁸¹ and Sokoloff.²²⁸ To these I add one successful case of my own, in which the moderately enlarged spleen was firmly adherent to the fundus of the uterus. We thus have in all a record of 60 splenectomies for idiopathically enlarged wandering spleen, with 54 recoveries and 6 deaths, a mortality of 10 per cent.

Ectopic Hypertrophied Spleen with Twisted Pedicle—As has already been said torsion of the pedicle is an accident that may occur in any case of wandering spleen. This may take place slowly so as to cause a gradual enlargement of the organ. In other cases the twist occurs suddenly and gives rise to most acute symptoms similar to those caused by the twisting of the pedicle of an ovarian cyst. It is usually possible in these cases to make out the tense and tender spleen, but in other instances operation has been performed for supposed intestinal perforation or strangulation.

Splenectomy is an operation of necessity in this condition and the results of the cases that I have been able to find since 1900 are surprisingly good,—11 cases without a death. Prior to 1890 splenectomy for wandering spleen with twisted pedicle was done 5 times with only 1 recovery and 4 deaths and from

1890 to 1900, 11 times with 7 recoveries and 4 deaths. The 11 additional cases which I have collected include one case each by Chandelux⁵², Cocran⁵⁴, Hunter¹¹¹, Steinbrueck²³³, Ullmann²⁵⁰, one case by Childe⁵³ complicated by a large subcapsular hemorrhage, one case by Wallace²⁵⁴ in a girl 12 years old, two cases in which the spleen lay on the right side of the uterus by Edge,⁷² and by Webster²⁰⁰ and one case by Vincent and Cabanes,²⁵³ in which the spleen lay in the right iliac fossa.

Malarial Hypertrophy of the Spleen—Malarial fever is a well-recognized cause of chronic splenic tumor. The "ague cake" occurs in individuals who are either repeatedly exposed to infection, or in those who are insufficiently treated. Such patients develop a more or less pronounced cachexia and for this reason splenectomy has been repeatedly performed in the mistaken idea (Jonnesco) that the spleen continues to be a habitat for the malarial parasites.

The chief indications which call for the removal of the malarial spleen are its increased size, increased mobility, its consequent tendency to rupture, and the danger of acute torsion of the pedicle. Spontaneous rupture is not infrequent in the Tropics, as the organ is easily lacerated by minor grades of traumatism that would not seriously affect a healthy spleen. The chief factors in producing mortality appear to be the large size of the tumor, and the presence of marked anæmia and cachexia.

In the period before 1890 splenectomy for enlarged malarial spleen was done 24 times with 9 recoveries and 15 deaths, and during the period 1890 to 1900, 64 times with 49 recoveries and 15 deaths. Since 1900 I have been able to collect 58 splenectomies by 31 operators, with 50 recoveries and 8 deaths (see bibliography), to which I add 3 successful cases of my own making 61 splenectomies with 53 recoveries and 8 deaths, a mortality of 13.1 per cent.

Ectopic Malarial Spleen—The same indications for operation apply here as in the case of the idiopathically enlarged wandering spleen. Reports of the cases of splenectomy

in this condition would seem to indicate that the operation is performed at a more favorable period in the patient's illness as the mortality is exceedingly low. Prior to 1890, 11 cases are reported with no deaths, and from 1890 to 1900, 15 cases with 14 recoveries and 1 death. Since 1900 I have collected 14 additional cases without a death. Of these, 8 are reported by R. Schwarz,²¹⁹ and one each by Bargellini,¹⁶ Carini,⁴² Kelley,¹²⁸ Nuñez,¹⁷⁴ Potherat,¹⁹⁰ and Sakharov.²¹²

Ectopic Malarial Spleen with Twisted Pedicle—As has already been said in speaking of idiopathically enlarged spleens, torsion of the pedicle is an absolute indication for operation and removal of the spleen. Prior to 1890 this was done in two cases with 1 recovery and 1 death, and from 1890 to 1900, 3 times with 2 recoveries and 1 death. Since 1900 I have collected 7 cases without a death, 2 cases reported by R. Schwarz,²¹⁹ and one each by Bennett,²¹ Coen,⁵⁵ Montanari,¹⁶⁵ Pozzi,¹⁹⁴ and Vignard.²⁵²

Splenic Anæmia—Banti's Disease—Under the term splenic anæmia are grouped certain cases of splenic enlargement associated with anæmia. There is no history of malarial fever and the subsequent course of the disease differs from that of chronic malaria with enlarged spleen. Banti, in 1894, called attention to the frequent development of cirrhosis of the liver as the disease progresses, and the term Banti's disease is really applicable to those cases only which show the characteristic signs as he described them, viz, anæmia, splenomegaly, and hepatic cirrhosis with ascites. In splenic anæmia there is no general glandular enlargement, which serves to distinguish it from Hodgkin's disease with splenic involvement. It is differentiated at once from leukæmia by the blood picture. The usual findings in splenic anæmia are a diminution in the red cells to an average of 2,500,000 to 3,000,000 per cmm with a relatively greater decrease in the proportion of hæmoglobin, so as to produce the picture of a very severe chlorotic anæmia. The leucocyte count is characteristically low, usually ranging from 2000 to 3000 per cmm. The leucocytic formula departs but slightly from the normal although the e

may be a slight increase in the relative proportion of the mononuclear elements. Abnormal blood cells,—myelocytes, nucleated red cells, etc.,—do not appear in the circulating blood.

The etiology of Banti's disease is absolutely unknown, and much careful study has failed to show whether the anæmia is secondary to some condition in the spleen or whether both the anæmia and splenic enlargement are dependent on some primary condition. As the usual course of the disease is gradually downward it has been hoped that the patient may be cured by removing the spleen. In two carefully studied cases operated upon by Harvey Cushing and J. C. Warren in 1898 and 1900 the patients are reported well and strong after 8 years and 6½ years respectively.

Prior to 1900 there are reports of 17 splenectomies in splenic anæmia with 12 recoveries and 5 deaths. These cases are cited in a paper by Torrance²⁴⁵ who records one successful case of his own in 1907 and collects 18 other cases in which splenectomy was done between 1900 and 1907 with 14 recoveries and 4 deaths. These 18 cases were reported or operated upon by Harris and Herzog, Warren, Jaffe, Tscherniachowski, Cushing, Mayo (2 cases), Halsted, Bevan, Gordon, Jonas, Clarke, Laspeyres, Hart, Koenig, Harris, Armstrong, and Carr. I have been able to find 25 additional cases, reported since 1900 and not mentioned in Torrance's article, with 22 recoveries and 3 deaths, viz. Bérard²², Bucco⁴⁰, Caro⁴⁵, Carstens⁴⁷, Davis⁶², del Castillo Ruiz⁴⁸, Flammer⁷⁹, Gangitano⁸⁰, Latarget¹³⁷, Legnani¹⁴¹, Levison¹⁴³, Martinelli¹⁵², Polosson and Violet¹⁸⁸, Quénu and Duval¹⁹⁵, Rieppi, 2 cases²⁰⁴, Roger, 2 cases²⁰⁷, Stirling, 2 cases²³⁴, Tansini, 2 cases^{238, 239, 240}, Thiel²⁴¹, Thienhaus²⁴², and Umber²⁴⁹. In 4 of these cases, those of Bucco, Gangitano, and the two of Tansini, the patients were in the so-called third stage of Banti's disease, and Talma's operation was done in the attempt to control the ascites. Three of these cases recovered and 1 died.

We thus have in all, up to the present writing, reports of

61 cases of splenic anæmia, or Banti's disease, treated by splenectomy with 49 recoveries and 12 deaths, a mortality of 19·5 per cent

Cysts of the Spleen—Three kinds of cysts have been found in the spleen (1) non-parasitic cysts (serous cysts, blood cysts, and lymph cysts), (2) hydatid cysts, and (3) dermoid cysts.

There is only one reported instance of dermoid cyst of the spleen. This was reported by Andral in 1829, and was said to contain fatty matter like tallow, with hairs scattered throughout.

Hydatid cysts are the most common form of cysts of the spleen, but are only found in those countries in which hydatid disease occurs. These cysts may attain large size and are most commonly treated by incision and drainage. In other instances splenectomy has been done. Prior to 1890 there are records of 5 splenectomies with 2 recoveries and 3 deaths, from 1890 to 1900, 10 splenectomies with 9 recoveries and 1 death. Since 1900 I have found reports of 8 splenectomies with no deaths, viz, Carnabel⁴⁴, Delore⁶³, von Herczel¹⁰⁵, Jordan¹²⁵, Lataiget¹³⁷, Slavchev²²⁷, Tricomi²¹⁶, and Giannettasio⁹⁰.

Non-parasitic cysts may be unilocular or multilocular. The most common kind is the blood cyst, which results from hemorrhage either into the substance of the spleen or just beneath the capsule. A history of trauma is obtained in many cases, while in other instances the cyst probably results from a partial rupture of the spleen during the course of some acute infection, such as typhoid fever. In not a few of the recorded cases the cyst has been found in distinctly hypertrophied spleens, which, as has already been mentioned, are especially liable to injury. It is questionable whether some of these cases should really be classified as blood cysts because the condition, as described, appears to be simply a subcapsular hæmatoma. Blood cysts of long standing usually show a distinct thick capsule, and are found to contain shreds of fibrin and granular detritus.

Serous cysts are in all probability hemorrhagic in origin, and, as Moynihan says, the solid constituents of the blood are no doubt deposited laminally upon the wall of the cyst, the fluid contents becoming thereby clearer. The operative procedure in cases of serous cysts will depend on conditions as found upon opening the abdomen. Simple puncture and the withdrawal of the fluid is not only obsolete but dangerous. If the cyst is of such size that most of the spleen tissue is destroyed, splenectomy is the operation of choice, provided there are not too many dense adhesions about the organ. If, as in some reported cases, *e g*, Powers' case,¹⁹² splenectomy would be either impossible or extremely hazardous, then it becomes necessary to drain the cyst, after suturing it to the abdominal wall. Occasionally the cyst can be enucleated, as in a recent case of mine, in which a cyst the size of a goose egg was shelled out from the under surface of the spleen and the raw surface of the spleen closed by two sutures threaded on blunt liver needles.

Prior to 1890 splenectomy was done 4 times for non-parasitic cysts without a death, from 1890 to 1900, 3 times with no mortality. Powers¹⁹² writing in 1906, has collected six cases of non-parasitic cysts reported since 1900 in which splenectomy was performed with no deaths, *viz*, cases by Michailowsky, Routier, Dalinger, Jordan, Monnier, and Heinrichus. In addition to these I have collected 6 more cases of splenectomy for this condition, in all of which recovery ensued, *viz*, Bacelli¹³, Bryan³⁸, Gerard⁸⁹, Israel¹¹², Leone¹⁴², and McMurtry¹⁶⁸. This gives a total of 19 splenectomies for non-parasitic cysts of the spleen with 19 recoveries and no deaths.

Leukæmia—The removal of the spleen in splenomyelogenous leukæmia is very definitely contraindicated. In the early period of splenic surgery, splenectomy was repeatedly performed in the hope of eradicating the disease. In 1894, Vulpus and Ceci collected 28 cases of splenectomy in leukæmia with 25 deaths immediately after the operation. Of the 3 cases that survived the operation one lived 13 days, another

8 months, while the third is reported as having been cured (Franzolini's case)

The total number of cases of leukæmia that were treated by splenectomy up to 1900 number 42. Of these, 4 are reported to have recovered and 38 died. Since 1900 I have found 6 additional cases, viz, Blanquinque²⁸, Cetnarowski⁵⁰, Lindner¹⁴⁶, McGraw¹⁵⁶, Piquand¹⁸⁵, and Warren²⁵⁷. Four of these cases died very promptly after operation, while 2 cases—those of Lindner and Warren—survived. Warren's case lived about four years while the late result in Lindner's case is not known. To these I add one case of my own, in which the patient died 5 days after operation. A post-mortem examination was not obtained, and I was not able to determine the exact cause of the fatal termination as there were no evidences of either hemorrhage or peritonitis. This makes a total of 49 splenectomies in myelogenous leukæmia with 6 recoveries and 43 deaths, a mortality of 87.7 per cent.

From these results it is obvious that splenectomy is unjustifiable in leukæmia. Hemorrhage and shock are the chief factors in the mortality of this operation. In addition, our present conception of the bone marrow changes in this disease would seem to demonstrate the futility of splenectomy to stay the progress of the malady.

Tuberculosis of the Spleen—Tuberculosis of the spleen does not occur as a primary affection, but nevertheless several interesting cases are on record in which a tuberculous spleen has been removed with subsequent entire recovery. These cases all presented splenic tumors and in one of them, at least, the diagnosis of tuberculous spleen was entertained because of coincident signs in the lungs. It may be said, however, that it is impossible to make a diagnosis of tuberculosis of the spleen and the condition can therefore never be treated as such.

Prior to 1890 there is a report of only 1 case of splenectomy for tuberculosis, and this resulted fatally (Burke's case). From 1890 to 1900 there are reports of 3 cases by Bland-Sutton, Lannelongue and Vitrac, and Marriott. These 3 cases all recovered, and Marriott's case operated upon in 1891, was reported alive and well in 1906 (Moynihan). Since 1900

I have found 6 cases of splenectomy for tuberculosis of the spleen, with 5 recoveries and 1 death. These cases were reported by Bayer,¹⁰ Caile,⁴³ Cominotti,⁵⁸ Delore,⁶⁴ Franke,⁸² and Grillo.⁹³ The case of Quénu and Baudet (1898) was not a typical splenectomy, as only a part of the spleen was removed and the lower pole drawn into the peritoneal wound and drained, suppuration continued for 4 months, and tubercle bacilli were found in the discharge. Bayer's paper has record of 9 of these cases, including that of Quénu and Baudet. Franke's case recovered from the operation but died 26 days later after leaving the hospital against his orders.

Sarcoma of the Spleen—An excellent résumé of the subject of sarcoma of the spleen is to be found in the paper by Jepson and Albert¹¹⁰ in which are collected all the cases up to and through 1904, including their own case in which splenectomy was done. Since that time I have found only one instance of splenectomy for sarcoma of the spleen, and that is the case reported by Willy Meyer in February, 1906.¹⁰¹ This was a round-celled sarcoma and apparently not primary, as there were evidences of further metastases in the abdomen. This patient recovered from the operation and was in fair health 2 months later.

Eleven cases of splenectomy for sarcoma of the spleen are collected by Jepson and Albert. Of these 8 recovered and 3 died. One patient (Fritch-Ashe) lived 6½ years and then died of a cardiac affection. Jepson's patient was in good health 10 months after the operation. Three of the 8 cases are known to have died from recurrence of the growth.

Although the spleen seems to possess a relative immunity to secondary involvement by new growths, yet secondary sarcoma is undoubtedly more common than a primary growth. It is quite possible, however, that a sarcoma may originate in either the capsule and trabeculæ, lymphoid tissue, or endothelial cells, giving rise respectively to fibrosarcoma, lymphosarcoma, and endothelial sarcoma (Jepson). Except for the firm, solid, and usually irregular tumor, there is nothing characteristic in the symptoms, or in the blood picture, of sarcoma of the spleen.

Carcinoma of the spleen has never been recorded in any case which will bear investigation (Moynihan)

Abscess of the Spleen—Abscess of the spleen is a distinctly rare condition, and is always secondary to an infective lesion either in the course of the blood stream or in immediate contiguity to the spleen. The most common cause is an infected embolus which gives rise to a septic infarct. This may occur in the course of an acute infectious disease, or follow some local suppurative lesion, especially in the portal area, such as appendicitis, pyosalpinx, etc.

Surgical treatment is always indicated in abscess of the spleen. Incision and drainage is the operation of choice, especially if the abscess is pointing, or dense adhesions are found about the spleen. In a few cases splenectomy has been done 3 times prior to 1890, and 4 times between 1890 and 1900. All 7 of these cases recovered. Since 1900 I have found reports of 2 splenectomies for abscess with 1 recovery and 1 death, viz., Eberhart,⁷¹ streptococcus infection, necrosis and abscess of spleen, recovery from operation, died 3 months later from pyæmia, and Karewski,¹²⁷ traumatic, necrosed spleen with subphrenic abscess, recovery.

Miscellaneous Affections of the Spleen—Five splenectomies, with 4 recoveries and 1 death, have been performed since 1900 for "pseudoleukæmia." Two of these cases, DeRenzi⁶⁷ and Salvia,²¹³ were instances of infantile splenic pseudoleukæmia, with recoveries in each. Rochard's²⁰⁵ case was probably one of splenic anæmia; Cetnarowski's⁵⁰ probably a malarial hypertrophy, while the exact nature of Erbkam's⁷⁵ case is not clear.

Wolff,²⁶⁴ in 1906, reports the successful removal of the spleen in a case of infantile splenic anæmia.

Two splenectomies have been done since 1900 for benign growths, viz. von Burckhardt⁴¹ removed the spleen together with a growth involving the splenic ligament which proved to be a myxofibrolipoma; and Noguchi¹⁷² extirpated the spleen together with a very large peritoneal lipoma. Both patients recovered.

Tietze ²⁴³ performed a successful splenectomy on a patient who had an echinococcus cyst of the spleen opened 3 years previously. The spleen was removed in order to cure a persistent sinus.

Winckler ²⁶³ reports a case of aneurism of the splenic artery in which he did a splenectomy. The patient recovered.

My sixth case of splenectomy may be tabulated in this group. The patient had been operated upon three years previously for an abscess of the spleen, the organ being fastened to the abdominal wall, incised and drained. She came to me with a good-sized ventral hernia in which was found a moderately large incarcerated spleen. The spleen, together with a large portion of adherent omentum, was removed, and the hernia repaired. In addition, complete hysterectomy was performed for carcinoma of the body of the uterus. The patient made a good recovery, and was reported to be in good health 2 years later.

Prior to 1900 there are records of 2 cases of benign growth of the spleen treated by splenectomy, with 1 recovery and 1 death.

WOUNDS AND INJURIES OF THE SPLEEN

Rupture of the Spleen—Subcutaneous rupture of the spleen is not a very rare accident. The normal spleen is only apt to be damaged by crushing injuries, but an enlarged spleen is readily torn by blows, not a few cases being due to kicks from a horse, and by falls. It is surprising how trivial an injury may cause a laceration of a hypertrophied spleen. Rupture of the spleen is particularly fatal because of the very extensive hemorrhage that almost always ensues. Immediate operation is imperative and it is usually found necessary to remove the spleen. Berger,²⁴ in 1902, collected 67 cases of ruptured spleen treated by splenectomy with 38 recoveries and 29 deaths.

Penetrating Wounds—These are caused either by gunshot or stab wounds. The spleen is very rarely the only organ injured and the prognosis depends very largely upon the extent of the traumatism. The indications are for immediate opera-

tion, but the exact method to be followed in treating the wounded spleen can only be determined after the abdomen is opened. In some cases the splenic wound can be closed by suture, or the wound may be cauterized and tamponed. If the injury is multiple, or the rent large, splenectomy is the operation of choice. Berger's statistics (loc cit) give 6 cases of gun-shot wound treated by splenectomy with 2 recoveries and 4 deaths, and 7 cases of stab wounds in which the spleen was extirpated with 5 recoveries and 2 deaths.

Grouping together all traumatic lesions of the spleen there are reported up to 1900, 37 cases with 20 recoveries and 17 deaths. Since 1900 I have collected 113 cases (see bibliography) with 79 recoveries and 34 deaths. Of these 113 cases, 11 were gun-shot wounds with 8 recoveries and 3 deaths, viz. Brennflech³⁶; Carr⁴⁶; Freund⁸³, Graf,⁹² 2 cases, Hartmann¹⁰¹, Hotchkiss¹⁰⁹, Lebreton¹⁴⁰, Longo¹⁴⁸; Noetzel¹⁷¹ and Penkert¹⁸², and six were stab wounds, viz. Bernhard²⁵; Ciechomski⁵¹, Demons⁶⁵, Korn¹³³; Krjenkow¹³⁴; and Moses¹⁶⁶.

We thus have reported in all, up to 1908, 150 cases of splenectomy for injuries and wounds of the spleen with 99 recoveries and 51 deaths, a mortality of 34 per cent.

SUMMARY

As shown in the preceding table, there are herewith collected and tabulated 708 operations of splenectomy with 514 recoveries and 194 deaths, a mortality of 27.4 per cent.

In the period from 1900 to 1908 there are records of 355 splenectomies with 289 recoveries and 66 deaths, a mortality of 18.5 per cent. If the instances of removal of the spleen for traumatic affections of that organ be excluded there remain 242 splenectomies with 210 recoveries and 32 deaths, a mortality of 13.2 per cent. The well-recognized contraindication to operation in leukæmia may furthermore serve to exclude the seven cases in this series, which leaves a total of 235 splenectomies for diseases of the spleen with 208 recoveries and 27 deaths, a mortality of 11.5 per cent.

SUBCUTANEOUS RUPTURE OF THE SPLEEN *

REPORT OF CASES WITH REMARKS

BY GEORGE G. ROSS, M.D.,

OF PHILADELPHIA,

Assistant Surgeon German Hospital, Surgeon Germantown Hospital

CASE I—Robert S. Age 8. History of having fallen 8 feet down a cellar way, striking on left side of abdomen in left hypochondriac region. Accident November 3, 1907.

The first urination after the accident showed evidence of blood. He did not vomit, no marked evidence of shock, bowels moved normally. The next two succeeding days he was not so well and when I saw him two days later he presented the following symptoms:

Expression anxious, indicating some severe abdominal lesion. Some meteorism, but no vomiting. Temperature 102, pulse 20, respiration rapid and shallow. Lips and mucous membrane pale. Rigidity of left rectus muscle, tenderness most marked over splenic area. Complained of pain in left upper abdomen. The kidneys and bowels had acted normally and showed no evidence of blood. The degree of traumatism and its application to the splenic area, followed by the evidence above related, makes the diagnosis of contusion of the spleen, slow hemorrhage and a low grade, more or less localized, peritonitis, most reasonable. He also had a contusion of the left kidney as evidenced by the one hemorrhage. The boy had a slow but satisfactory recovery without operation.

CASE II—Jacob H. Age 21. Painter. Was admitted to the German Hospital on the afternoon of September 28, 1907, having been referred by Dr. Klemm.

Patient's previous history of no importance or bearing on present condition.

Dr. Klemm kindly furnished the notes of the accident and the condition immediately following:

* Read before the Philadelphia Academy of Surgery, March 2, 1908

"Jacob H came to my office stating that two hours before he had fallen from bay window on a fence, striking on his upper abdomen. He soon recovered sufficiently to walk to his home, a distance of ten squares, then to my office another six squares and back to his home. He was pale, not able to stand fully erect, his pulse was 96, temperature normal, he referred his pain to the epigastrium, radiating toward the left side and the back. I advised him to go to the German Hospital for observation, to which his mother objected, then I ordered him to bed and to let me know if he got worse. The next day I found him, with abdomen distended, pulse 136, temperature 100, more pale and willing to go to the hospital at once."

On admission he was very pale, expression anxious. Temperature 100, pulse 148, respiration 26. Abdomen showed no ecchymosis, bruise, cut or evidence of traumatism. Lungs clear. Heart action rapid. No murmurs. Pulse rapid, weak and running. Abdomen moderately distended, general rigidity and marked tenderness. Complained of severe abdominal pain, most intense in the left hypochondrium. Hæmoglobin 48 per cent, leucocytes 20,000.

Operation on admission, 24 hours after the injury. Abdomen was opened through right rectus muscle with line of umbilicus as central point. A large amount of very dark unclotted blood escaped. A rapid survey of small and large intestine and their mesenteries, also of the liver, proved them to be intact. As the examination approached the spleen it was noticed that the blood was clotted and an examination discovered a rent in the spleen. The patient by this time was practically pulseless. Intravenous salt solution was started—a total of 2000 c.c. being given. Another incision through the abdominal wall over the spleen and three pieces of gauze were packed around the organ. A stab wound over the pubis was made for the insertion of a glass drainage-tube, the original wound was closed, excepting at the lower angle, where one piece of gauze was placed for drainage. The abdomen was not washed out. The patient made a slow recovery. On the twentieth day the temperature shot up to 104 and the pulse to 138 without a known cause, and stayed up until the thirty-fifth day, when it again reached normal. The leucocyte count at this time was 9700. Widal negative.

Subcutaneous injuries of the spleen vary from simple contusion to complete pulpification, the extent of the injury being governed by the amount and direction of the applied force and the condition of the organ. An abnormal spleen either enlarged or unduly friable will be more readily and more severely injured by minor degrees of traumatism. That the normal spleen is liable to severe injury is proven by the number of cases on record. At the height of its functional activity, the spleen is engorged with blood and is at this time more liable to injury. This condition occurs some hours after digestion. The two cases herewith reported illustrate rupture in two degrees of severity, in normal or presumably normal organs. Both were in males.

In Berger's collection, 300 cases were in men and 60 in women.

Subcutaneous injuries are more common than through open wounds. Edler's 160 cases show 51.8 per cent as subcutaneous to 48 per cent from gun shot and stab wounds.

Berger, *Archiv fur Klin Chirurgie*, 1902, vol 68, pp 768-817, gives a review of all cases up to 1902, from which the following facts have been deduced:

Frequency of rupture of the spleen compared with same injury to the other solid viscera due to traumatism he gives as follows: rupture of spleen, 20 per cent, rupture of kidney, 22 per cent, rupture of liver, 37.5 per cent.

Contusion of the spleen regarded as an authentic diagnosis, is in many cases hard to diagnose from rupture. The symptoms are pain and tenderness in region of the spleen, enlargement of the organ, fever, shock without evidence of hemorrhage.

Age of Cases—Report of German cases: age from 0 to 10, 38 cases, 11 to 20, 33 cases, 21 to 30, 42 cases, 31 to 40, 32 cases, 41 to 50, 15 cases, 51 to 60, 15 cases, over 60, 9 cases. Report of English cases: age from 1 to 10, 11 cases, 11 to 20, 18 cases, 21 to 30, 15 cases, 31 to 40, 15 cases, 41 to 50, 6 cases, 51 to 60, 11 cases, over 60, 11 cases.

NOTE—One case in a new-born infant, which was dropped on floor in precipitate labor

Pathology—Somewhat less than half of the ruptures affected a diseased spleen, in most cases malarial. It was especially common also during acute infections with splenic enlargement

Of 132 pathological ruptured spleens 93 were malarial, 15 only enlarged, no cause stated, 5 in typhoid, 1 in typhus, 1 in pneumonia, 3 in leukæmia, 1 in hereditary syphilis and alcoholism with liver cirrhosis, 9 in pregnancy, 1 in tuberculosis, 1 in other diseases

Spontaneous Rupture—Referred to by Berger. He gives over 30 examples, some with slight trauma, as bending or in labor. He reports one case in a man lying absolutely still

Prognosis of Ruptured Spleen—Unoperated of 220 cases, 17 recovered—mortality, 92.3 per cent. *Operative results* splenectomy, 67 cases, 38 recovered, 29 died—mortality, 56.7 per cent, splenorrhaphy, 2 cases, 1 recovered, 1 died—mortality, 50 per cent, tamponade, 6 cases, 5 recovered 1 died—mortality, 83.3 per cent

In the above splenectomies 13 had complicating injuries, of which 9 died. In two of the recovered ones the complications were very slight

LATER REPORTS OF RUPTURE OF SPLEEN

1 BEAUMONT Trans Clin Soc London, 1902-3, xxvi, 261. Reports case of man hit by wagon tongue, spleen was ruptured. Operated Splenectomy. Developed a left pleurisy and empyema. Had enlarged lymphatics one month after operation. No pathology of spleen.

2 FREUND St Louis Med Jour, 1906, xlii, 135-137. Reports one case of splenectomy for rupture with recovery. Operation within 24 hours. Noted leucocytosis of 9000 on admission, 18,000 on third day.

3 KIRCHNER Ibid. Mentions 5 or 6 cases with 3 or 4 recoveries. No exact data.

4 BREWSTER Boston M and S Jour, 1904, cl, 211. Reports a case of rupture of the spleen on a female of 6. Operated evening of the second day, with diagnosis of probable rupture of intestines. Wound in spleen packed, a drain was brought out by counter opening in flank.

5 SIMPSON Lancet London, 1906, ii, 364. Case of splenectomy for ruptured spleen. Operated in 5¾ hours.

6 NOETZEL W Beitr z klin Chirurgie, 1906, xlviii, 309. Reports

five cases of splenectomy for rupture Two recovered One operated in 24 hours One on third day Of the three that died (no pathological report), 1 died apparently of shock, 1 of rupture of liver and heart complicating splenic condition, 1 of rupture of intestine (not found at operation) He calls attention to need of examination for associated lesions of viscera when doubtful

7 FRANK Munch med Wehnschr, 1906, lIII, 189 Reports two cases of splenectomy for rupture One operated within 24 hours and one on second day The latter worked 2 days after accident—had subcapsular hemorrhage which broke second day and necessitated operation Complicated by pneumonia and pleuritis No pathological report

8 FONTOYNONT Bull et Mem Soc de Chir de Paris, 1905, us xxxi Reports a case of splenectomy for rupture in a woman of Madagascar, who had malaria and syphilis Operated in 2 hours Spleen removed as was also an injured portion of tail of pancreas Clamps left on vessels Spleen free of blood weighed 500 grams It was hypertrophied and malarial

9 SCHLUETHER R E J Missouri Med Ass, 1905-6, II, 23-26 Reports splenectomy in boy of 14, for rupture Spleen entirely broken in half Operated in 18 hours Bleeding had spontaneously ceased He notes hypertrophy of lymphatics in second week after operation

10 ANORAY Bull et Mem Soc de Chir de Paris, 1904, xxx, 900-911 Reports two cases of splenectomy for rupture, with recovery He advises resection of ribs to expose the field of operation He refers to several other cases and to 3 cases of spontaneous cure

11 SHERWOOD Brooklyn Med Journ, 1906, xx, 62 Reports case of rupture of spleen Operation in 3 or 4 hours Hemorrhage all back of peritoneum and no free blood in peritoneal cavity Spleen and clot left undisturbed and wound closed Patient recovered

12 DAVYS Indian Med Mag Calcutta, 1904, xxxlx, 219 Reports spontaneous rupture of spleen in native while lying down No accident Died in ½ hour Postmortem Spleen has rent in anterior angle, is soft and enlarged to double its size No pathological report

13 THURSTON Ibid p 379 Reports operation for peritonitis Ruptured spleen Spleen not enlarged The blood had become encysted, the breaking of which caused the peritonitis No free blood in abdominal cavity

The evidence upon which a diagnosis can be established is the history of traumatism to the upper abdomen and especially when applied to the left side, shock, pain, tenderness over the spleen, rigidity of the recti muscles, more marked of the left, later signs of hemorrhage and meteorism The abdominal wall rarely shows the evidence of force, although it be sufficient to rupture any one or several of the abdominal organs The absence of ecchymosis or bruising should not mislead one

As we see these cases in the hospital the impression one receives is that the patient has a serious hurt and urgently requires operation, and it is my opinion that the time spent in making a fine differential diagnosis would be better spent in opening the abdomen on the evidence of a ruptured viscus and repairing the condition or conditions found

If the diagnosis of injury to the spleen can be established an incision through the left rectus muscle offers the best route for handling the conditions. Unfortunately the signs of hemorrhage into the peritoneal cavity and the meteorism so often obscure the symptoms that we must make a compromise incision, that through the right rectus muscle being the best. The umbilicus should be on a line with the middle of the incision. One can readily and rapidly enlarge upward and downward. Injuries to other organs will be more readily seen and recognized by this route.

GANGRENE OF THE GALL BLADDER

BY ANDREW STEWART LOBINGIER, M.D.,
OF LOS ANGELES, CAL

THIS comparatively rare condition has been mentioned by all of the prominent writers on the diseases of the gall bladder, but there have been singularly few cases reported in literature. In conversation with a number of surgeons here and abroad, whose wide experience in the pathology of gall stone disease is a matter of international note, I have been surprised at the few instances of true gangrene of the gall bladder which have fallen under their observation. This fact and certain unusual features in the pathology, would seem to make the case here reported one of some scientific interest.

CASE—F J, Teuton, age 55, married. He was first seen February 26, 1906, by Dr Paul Adams, by whose courtesy I was permitted to see the patient. The family history was negative. Until recently he had been a resident of Brooklyn, N Y. Up to five years ago he had been a hard drinker, chiefly whiskey. On Oct 15th, Nov 15th and Nov 29th, 1905, he had suffered severe attacks of pain in the region of the gall bladder. These attacks, which were supposed to be gall stone colic, developed and disappeared very suddenly and left the patient prostrated. Jaundice, more or less persistent, had been present for more than three years. Early in the history of the case he was said to have sugar in the urine and an excess of urea.

When first called Dr Adams found the patient suffering severe pain in the region of the gall bladder. These pains radiated downward, as well as upward toward the right scapula. The liver was somewhat enlarged extending an inch below the costal border. There was marked tenderness on light pressure over the gall bladder. The heart showed a moderate systolic murmur. There was a well marked jaundice, and bile and a trace of albumen were found in the urine. At this time the temperature was normal and the pulse 90, but the patient felt sure the pain he was suffering was more severe than in any previous attack. I

was called in by Dr Adams on March 1st. The patient was a large plethoric subject with jaundiced skin and conjunctivæ. His temperature was then 102.4° F and the pulse 118 and he had had several rigors. He complained of a severe pain in the right hypochondrium which extended through to the back. The right rectus was rigid and there was a dense mass in the region of the gall bladder, which was only slightly tender on firm pressure. The diagnosis was suppurative cholecystitis with localized peritonitis, and immediate operation was advised.

The operation was at the California Hospital on March 2nd. The gall bladder, which was several times the normal size, was gangrenous and distended with gas. It was covered and walled off from the peritoneal cavity, by the gastrohepatic and a portion of the great omentum. Surrounding the gall bladder was a pool of dark slate-colored purulent fluid. The omentum was deeply injected and stained by this dark fluid. The fluid was sponged away and the gall bladder opened. It contained gas only, the walls were moist and were distinctly emphysematous, crackling under pressure between the thumb and finger. The mucosa easily separated from the wall and both were gangrenous. In the upper portion of the cystic duct was an irregular stone about the size of a small hazelnut, imbedded in sand and gravel like millet seeds. No other concretions were found. The common and hepatic ducts were probed and found clear. The gall bladder was freed of further adhesions and removed, a drain being placed in the remaining portion of the cystic duct. A pocket above and one below the former position of the gall bladder were drained with cigarette drains. The convalescence was not marked by any unusual incident and the patient left the hospital March 16th. A slight mucus discharge continued for several weeks from the drainage fistula.

The feature of especial interest in this case is the emphysematous condition of the gall bladder wall and the distention with gas of the bladder itself. Of the bacterial flora present little can be said, as the material taken for smear and culture was accidentally destroyed. One might assume the presence of coli, probably the commonest form of gas producing bacillus incident to the gall bladder.

THE TREATMENT OF THE APPENDIX STUMP AFTER APPENDECTOMY.¹

BY MURAT WILLIS, M.D.,

OF RICHMOND, VA.,

Adjunct Professor of Abdominal Surgery, in the Medical College of Virginia, Junior
Surgeon to Memorial Hospital

THE method of disposing of the stump of the appendix has often been said to be the only unsurgical feature in the operation for appendicitis. As a topic of discussion, this question almost invariably arises when two or more surgeons meet together, and I have been particularly impressed by the interest shown in this subject at various medical meetings and in the clinics that I have visited. Furthermore, this subject has formed the basis of several articles in the current medical literature, and as some of the writers' conclusions are at such variance with my ideas on the subject I determined to communicate with a large number of representative operators in this country, and to tabulate and analyze their replies. In accordance with this plan, and at the suggestion of Dr. George Ben Johnston, letters were sent to one hundred and twenty-five surgeons, including all the members of the American Surgical Association, and other well known operators, so as to obtain a general and impartial view of the subject. Each of these men was requested to answer the following list of questions:

- 1 Do you crush or ligate stump?
- 2 Do you divide with knife or cautery?
- 3 Do you use any chemical in disinfecting?
- 4 Do you bury the stump? (a) If so, how? (b) If not, why not?
- 5 Have you observed any difference in the intensity or character of pain between cases when the stump is buried or unburied?

* Read before the Southwest Virginia Medical Society, Jan. 16, 1908

6 Have you seen any ill effects arise from unburied stumps, if so, what?

7 Have you observed any harmful effects of any character from burying the stump?

One hundred and five replies have been received and the analysis of these reports has proved most interesting

The answers to the first three questions show the minor differences of technique practiced by different operators: Forty-eight both crush and ligate the stump, 29 ligate without crushing; 13 crush but do not ligate, 7 either crush or ligate; 4 neither crush nor ligate

In answer to question 2, the appendix is divided by the cautery by only 11 operators. The remaining number use either the knife or scissors

Many surgeons evidently believe in the attempt to disinfect the stump. Thirty-eight use carbolic acid; 15 use carbolic acid followed by alcohol, 10 use carbolic acid occasionally but not as a routine, 4 use the cautery; 10 use chemicals other than carbolic acid or the cautery; 28 do not attempt to disinfect the stump

The chief interest in compiling these statistics, however, lies in the answer to question 4. The analysis of the 105 replies show that 77 *always* bury the stump, 66 by ligating and inverting into wall of cæcum, 11 by invaginating the unligated stump into the cæcum, 11 *usually* bury the stump (leave unburied only in drainage cases), 3 have no settled method, 2 leave no stump; 11 never bury the stump, 1 does not answer the question

Thus it appears that the stump is always buried by 73.3 per cent and usually buried by 10.5 per cent of the representative surgeons in this country, while only 10.5 per cent make a practice of never burying the stump

Post-operative pain has been stated by different writers as a defect in the different methods of handling the stump. Of 103 replies to question 5, 78 have observed no difference whether the stump was or was not buried, 20 are unable to answer (personal observation on only one method), 3 state

that pain is greater when stump is buried, 2 state that pain is greater when stump is left unburied

In reply to question 6, 23 of the 105 reports make mention of untoward results that have followed simple ligation and leaving the stump unburied. The remaining answers state that they have not personally observed any ill effects, or else have had no occasion for observation because of the reason that they have never left the stump unburied. It seems worth while to mention in more detail these replies

(1) Four cases of intestinal obstruction from adhesions of the bowel to the stump, two of which were fatal—Armstrong, Montreal

(2) Many temporary fæcal fistulæ—Bevan, Chicago

(3) One case of fatal peritonitis, one case of fæcal fistula—Blake, New York

(4) Occasional fæcal fistula—Bryant, New York

(5) Several cases with very bad adhesions, one case of persistent suppuration—Estes, South Bethlehem, Pa

(6) One case slipped ligature—Gerster, New York (Operation by a house surgeon)

(7) One case adhesions on reopening abdomen—Gwathmey, Norfolk

(8) One case stump leaked, abscess—Harris, Chicago

(9) Occasional fæcal fistula—A B Johnson, New York

(10) Post-operative adhesions common—H A Kelly, Baltimore

(11) Two cases of ileus from adhesions—MacLaren, St Paul

(12) One case slipped ligature, peritonitis, death—Matas, New Orleans

(13) Fæcal fistulæ common—Monks, Boston

(14) One case of abscess, death—Munro, Boston

(15) Three cases of intestinal obstruction from bands adherent to stump—Oliver, Cincinnati

(16) Fæcal fistulæ, slow healing, oftener infection—Owen, Chicago

(17) One case stump sloughed, death, autopsy—Rixford, San Francisco.

(18) Occasional fæcal fistula—Senn, Chicago

(19) One case Fallopian tube found adherent to appendix stump—W J Taylor, Philadelphia

(20) Persistent sinuses—Vander Veer, Albany

(21) Fæcal fistulæ common—Watson, Boston

(22) Fæcal fistulæ commonly result—Weir, New York

(23) Fæcal fistulæ more common—Willard, Philadelphia

In striking contradistinction to the many complications following the practice of leaving the stump unburied, I am very much impressed by the fact that in the replies to question 7, only 2 surgeons out of 105 state that they have ever observed harmful effects of any character after burying the stump. These are as follows:

(1) "In one case a stitch gave way during the first defecation (after calomel) and a large exudate developed with symptoms of perforation. The exudate, however, was absorbed and the patient recovered"—Gerster, New York

(2) "Two secondary abscesses"—Mumford, Boston

Intestinal hemorrhage following invagination of the unligated stump has been reported frequently in the current medical literature. Although no inquiry was made in my letter as to the incidence of hemorrhage, yet it is of interest to note that 10 of the 105 replies contain statements in regard to this point. Several of these operators say that they have seen hemorrhage in the practice of their colleagues, but in addition not a few interesting personal cases are cited, in several of which the abdomen had to be reopened because the patient was almost pulseless. Several deaths from hemorrhage are reported in this series.

Although comment is hardly necessary after merely tabulating these statistics, yet attention may be directed in a brief way to several points.

Post-operative pain is one of the arguments advanced by the exponents of the unburied stump. The brilliant researches of Lennander, however, on the absence in the visceral peri-

toneum of nerve fibres which convey the sense of pain, serve to thoroughly invalidate this assumption, and in full agreement with this is the clinical experience of the vast majority of operators

Infection, and *abscess*, after burying the stump would seem from the analysis of these replies to be regarded in the light of a theoretical rather than practical objection to this method. It is to be noted that only 2 of the 105 operators, including the 11 who believe in leaving the stump unburied, report that they have observed any sequela of this character when the stump is buried, while no mention is made of any fatalities from this source

Adhesions following burying the stump are not reported in a single reply, although in some of the articles by exponents of the unburied stump the liability of adhesions to the region of the buried stump is one of the objections to this procedure. That adhesions do occur when the stump is left unburied is only too apparent by the number of cases of intestinal obstruction reported in these statistics which were found to be due to adhesions of the unburied stump to the omentum, small intestine, or abdominal wall

The chief objections to leaving the stump unburied appear in nearly one-fourth of the 105 replies. They are (1) obstruction to the bowel, (2) slipped ligature, with escape of fecal contents into the abdominal cavity, (3) adhesions of the raw surface of the stump to omentum, abdominal wall, and various nearby viscera. Two personal experiences with the unburied appendix stump impressed me very forcibly with the defects in that method

In the first case a myomectomy was done and a practically sound appendix was removed at the same time. As it was a perfectly clean operation, the appendix was ligated, amputated, and the stump allowed to fall back into the cavity. Two days after operation the woman developed post-operative distention of the bowel, the ligature was "blown off," with the escape of fecal contents into the abdominal cavity. Death occurred from general peritonitis, and the conditions as

described were confirmed at the autopsy. This case, to my mind, illustrates one of the most dangerous accidents that are liable to occur in any patient in whom the stump is simply ligated and not buried. Distention of the bowel may occur after any abdominal operation and it is easy to understand how the increased pressure within the bowel will balloon out the appendix stump into a pyramidal-shaped body, with the apex at the ligature, and the integrity of the bowel wall is thus jeopardized in every case in which any distention ensues.

Shortly after the above case was operated upon, a patient was admitted to Dr. Johnston's service with evident intestinal obstruction. Operation showed an unburied appendix stump adherent to the abdominal wall, and a kinking of the small intestine about this adhesion so as to cause a partial obstruction of the gut. The patient recovered after separating the adhesions, freeing the loop of intestine, and burying the appendix stump in the cæcal wall.

We always make it a practice to ligate and bury the stump of the appendix whenever practicable, and in following our results during the past three years I have never seen any ill effects that would lead us to make any change in our method of procedure.

I am very much indebted to the surgeons who replied to my letter and for the evident interest that they have displayed in this matter by personal letters and other communications.

EXCISION OF CARCINOMA OF THE RECTUM BY THE COMBINED METHOD.

WITH REPORT OF THREE CASES *

BY JOSEPH A. BLAKE, M D.,

OF NEW YORK,

Surgeon to Roosevelt Hospital

THERE has been a distinct swing of the pendulum in the last six or seven years toward the combined method (the abdomino-perineal) for the removal of cancer of the rectum. As yet the comparative value of the operation cannot be said to be determined and therefore, the report of all cases treated by this method is still of interest.

Its completeness and thoroughness, the great desiderata of operations for carcinoma, are its chief qualifications for merit and, at the same time, its chief drawbacks, on account of the greater danger incurred. It remains to be proven whether the results in regard to recurrence are sufficiently better than by other methods to justify the additional immediate operative risk.

It seems to me that no definite procedure should be considered desirable for all cases but that the operation should be designed to meet the indications in each individual case. To be more explicit, I would perform the perineal operation in early and low lying growths in which the anal sphincteric control can be preserved and, in general terms, would reserve the combined method for larger and higher growths which otherwise would have to be approached by the sacral route and for those in which the anal sphincters have to be sacrificed. This statement, while in general terms correct, has to be further modified, as will appear later.

I also believe that, when employing the combined method, all hope of preserving the natural site for the outlet of the in-

* Read before the New York Surgical Society, March 11, 1908

testine should be relinquished and that a permanent abdominal anus should be at once instituted. Exceptions to this last statement may occur in rare instances when it is exceptionally easy to draw the bowel down through the preserved sphincters. My reasons for preferring the establishment of an abdominal anus is that by this procedure the entire operation is rendered aseptic whereby the abdominal wound can be entirely closed and the perineal almost completely and with the minimum of drainage, advantages which are inestimable when the vitality of the patient has been lowered by a prolonged operation. For, if after removing the growth through the abdominal incision, the oral is united to the aboral segment either by the Maunsell method or through a parasacral incision, a second division of the bowel becomes necessary, the avenues of infection are opened and the operation is unduly prolonged. Even if the sphincter can be preserved, as in the Quénu method, the fixation of the oral end between its divided halves, consumes more time than the institution of an abdominal anus and introduces the element of infection into the perineal wound. Furthermore, in using the Quénu method, the temptation is always present either to divide the intestine too near the upper limit of the growth or to put it on too much tension, thus endangering its blood supply.

While it is often difficult to get the patient's consent to an abdominal anus, although it is far more efficacious and cleanly than an incompetent perineal or sacral one, I have felt so strongly about it that I have refused to operate unless I had consent for an abdominal anus in cases where the combined operation seemed best.

The advantages of the combined method have been dilated upon so often in various papers that it seems almost needless to repeat them. Besides, the opportunity of a far more radical removal than is possible by other methods, the chief advantages seem to me to be, first, that the abdominal approach permits a much fairer estimate as to the possibility of removal and, if on account of lymphatic or metastatic extensions, it is found to be impossible, the patient is spared a mutilating and danger-

ous operation and secondly, that the convalescence may be much shortened on account of aseptic healing, as has already been mentioned

The three following cases illustrate fairly well the above arguments

CASE I—Mrs G, manicurist, aged thirty-two years, was admitted to the Roosevelt Hospital in May, 1905 For two years she had had hemorrhage from the rectum, the last amounting to a pint, on the day of admission For two and one-half years she had had increasing constipation For two years pain, chiefly when at stool She had had one child two and a half years before admission, the delivery being instrumental Local examination revealed a large mass two inches above the anus, filling the rectum It was fixed, lobulated and soft and friable, bleeding freely Neither a tube or enema could be made to pass through it Numerous indentable masses were felt throughout the abdomen There was a small umbilical hernia The heart, lungs and urine were negative The general nutrition was poor The tongue was coated but moist The red cells were 3,800,000 Temperature was 98.8, pulse 88, respiration 22

Operation, three days after admission Nitrous oxide, ether anesthesia Trendelenberg position An incision four inches long, was made through the linea alba to the pubes The mass was found to extend upward to above the middle of the sacrum No lymphatic involvement was made out The intestine was divided at the lower part of the sigmoid flexure, the ends inverted and the oral end brought out through an intermuscular incision just within the left anterior superior spinous process of the ileum, and fastened there with a few sutures, the end being left unopened The aboral end was then drawn down over the pubes, the superior hemorrhoidal vessels ligated, the reflections of the peritoneum divided with scissors on either side and then across the front of the rectum at the bottom of Douglass' cul de sac The bowel was then freed down to the levators by blunt dissection So far, the operation was practically devoid of hemorrhage The abdominal wound was then covered with a moist towel and the patient placed in the lithotomy position The anus was closed with a heavy purse string suture of silk and then its external surface cauterized with the Pacquelin cautery The region was recleansed

and a sagittal incision made circumscribing the anus from the perineal body in front nearly to the tip of the coccyx. The dissection was carried up, removing the sphincters with the rectum and the bowel drawn down and out. The perineal wound was then repaired by suturing the levators together with catgut and the more superficial portions with catgut and silk worm gut, a tube being placed in the posterior angle for drainage. The patient was then again placed in the Trendelenberg position, the peritoneum repaired at the bottom of the pelvis and the abdominal wound closed with a tier suture without drainage. Time of operation, two hours and twenty-six minutes. She was returned to the ward with little shock. Temperature 98°, pulse, 120, respiration 40.

The post-operative course was exceptionally smooth; there was a reactionary rise of temperature to 101.8°, which immediately subsided to normal and remained so. The wounds healed per primam with the exception of slight infection about the drainage tube in the perineal wound. The intestine was opened at the artificial anus at the end of thirty-six hours. She was allowed up on the nineteenth day. The portion of intestine removed was distended and hardened in formalin. On longitudinal section it showed a remarkable valvular arrangement of the neoplasm. It involved three and one-half inches of the rectum, invading the perirectal tissues somewhat toward the hollow of the sacrum, and consisted of a number of dendritic masses filling the lumen and folded downward so that the fecal current could pass downward, but not even water could be injected upward. On section, it showed the structure of a malignant adenoma.

I have been unable to follow this patient further than that she was reported in good health six months after the operation.

The most noteworthy feature of this case was the remarkably smooth convalescence. The operation was very long, unnecessarily so, it being the first case I had done by this method. In my second case the length of the operation was shorter by nearly an hour. In this case, however, I was able to close the peritoneum over the intestine in the floor of the pelvis before it was removed and could, consequently, close the abdominal wound, the transfer of the patient from the

lithotomy back to the Trendelenberg position thus being saved

CASE II—Mr W, a farmer, aged sixty-six years, was admitted to the Roosevelt Hospital in June, 1906. He had had hemorrhages from the rectum for one year and pain for six months. Obstruction had not been marked. He had been cauterized for piles. He had gradually lost flesh and strength. He had had pneumonia five years before, otherwise his previous and family history was negative. Local examination revealed an ulcerated growth in the anterior wall of the rectum, extending from just above the anal canal upward for a distance of three inches. It did not obstruct. His general condition was unfavorable. He was emaciated, somewhat anæmic, the heart sounds were feeble, the arterial walls thickened, the lungs emphysematous, the abdomen negative, the tongue coated, the urine contained a trace of albumen and a few hyaline casts. hemoglobin 75 per cent, red cells 4,600,000. Temperature 98°, pulse 108, respiration 24.

Operation. Nitrous oxide gas anesthesia, time, one hour and thirty-five minutes. The same procedure was carried out as in the preceding case except as has been already stated, the abdominal wound was closed before removing the rectum through the perineal incision. In this case the levators could not be sutured together. Drainage was by a cigarette drain instead of by a tube as in the preceding case. The operation was followed by considerable shock and he was given an infusion, but at no time did his condition seem to be precarious. The highest temperature, 101.6°, was reached at the end of twenty-four hours, but immediately fell to normal, fluctuating between 99° and 101° for six days, after which it remained normal. The pulse fluctuated between 88 and 112 on the second day. The abdominal wound healed per primam but the cigarette drain did not drain properly and there was some infection of the perineal wound and about one-third of it healed by granulation. He was rather feeble and convalesced slowly but surely and was discharged, healed, at the end of five weeks.

The growth proved to be adeno-carcinoma.

He remained well for about twelve months and then failed rapidly, dying at the end of fifteen months, of "internal cancer," there being no evidence of intestinal recurrence.

This patient ordinarily would be considered an unfavorable subject for any operation, yet stood it well and made a satisfactory operative recovery

In the following case a preliminary artificial anus became necessary on account of the development of acute obstruction resulting from perforation and periproctitis. It also illustrates under what difficulties the operation is possible

CASE III—Miss R, forty years of age, was admitted to the Roosevelt Hospital on July 9, 1907. The only history obtainable from her was increasing constipation for a period of six months, followed four days before admission, by a sudden stoppage and a feeling of discomfort in the rectum. Cathartics were taken without relief, but gas and small quantities of feces were obtained by enemata which were only given with difficulty. On admission, there was a growth extending from the upper portion of the anal canal upward, blocking the rectum and involving the posterior vaginal wall. It seemed to be immovably fixed but was not particularly sensitive. Her general condition was fair, red blood corpuscles 3,600,000, hemoglobin 80 per cent, leucocytes 12,200, polymorphonuclears 89 per cent, temperature 100.6°, pulse 98, respiration 24.

She was kept for five days under observation, the intestine being gradually emptied by irrigations and enemata. The obstruction seemingly increasing, an inguinal colostomy was done, the gut being opened on the second day after operation. When under ether, the growth was carefully examined and found to be fixed and apparently extensively infiltrating, which condition was afterward proved to be largely due to periproctitis. Two days later this became more evident and the abscess was opened by an incision lateral to the anus. The abscess extended to above the levators but gradually cleared up, when it was found that the growth, although extensively infiltrating, could probably be removed, which was done two weeks from the institution of the colostomy. Under nitrous oxide, ether anesthesia, the colostomy wound being isolated with rubber tissue, a five inch median incision was made, the patient being in the Trendelenberg position. The intestine was divided far enough below the colostomy to allow inversion and the remainder of the intestine with the growth, removed in the same manner as in the first case reported.

The perineal excision, however, was much more extensive, including the entire posterior vaginal wall, the ischiorectal fat and the greater part of the levatores ani muscles. The resulting cavity seemed enormous and was closed with difficulty. The operation consumed two hours and thirty minutes, being prolonged rather than otherwise, by the presence of the colostomy. She was returned to bed in marked shock, the pulse being 140 and the temperature 96°. She responded well to heat and an infusion. The highest temperature, 100.4°, was reached on the second day, but after that remained normal. Healing of the abdominal wound was immediate but the perineal wound closed slowly by granulation. She, however, left the hospital within three weeks with a small granulating sinus.

Examination of the specimen showed that a perforation had occurred at the upper limit of the growth which caused the proctitis and sudden obstruction. The difficulties of excision were greatly increased by the presence of this suppurating sinus and it seemed remarkable that healing of the perineal wound occurred as rapidly as it did. The entire absence of sepsis following the operation is also noteworthy. The after-course of this patient, however, was far less favorable. A pulmonary metastasis appeared four months after operation, she dying two months later. The metastasis evidently was due to implication of the systemic veins in the tissues outside of the rectum. There was no local recurrence. The growth was an adeno-carcinoma.

These three cases throw little light on the curative value of the combined operation. In regard to the immediate operative risk, they impressed me strongly with its comparative safety. Although the shock may be great, the entire exclusion of the element of infection by means of the institution of an abdominal anus remote from the operation wounds, is greatly in its favor. Although patients are momentarily depressed by the severity of the operation, there is nothing in the condition of the wounds to interfere with convalescence. The dangers of the operation therefore, are restricted to the ordinary ones of shock and the anesthetic, it only being necessary that the technique should be good to practically ensure success. My own experience and that of others, shows that the mortality

of the low operations is largely caused by sepsis. In personal communications with other surgeons, I have gained from them the impression that their mortality in the combined operation is higher than in the parasacral route. I am inclined to attribute this to the fact that in many of their cases, complicated suture operations are done, the abdominal anus not being resorted to. There are certain cases in which the combined operation should be avoided if possible, notably obese males, in whom all abdominal operations are attended with great danger, but particularly this one, on account of the difficulty of handling the fatty intestine in a narrow pelvis and the large incisions necessary. Moreover, women, not only on account of the roomier pelvis but because of their insusceptibility to pelvic invasions, are far better fitted for this operation than males.

A résumé of my present opinions in regard to this subject may be briefly stated as follows.

That no single operative procedure for carcinoma of the rectum should be always carried out to the exclusion of others

That the decision between the perineal and combined methods depends chiefly upon the feasibility of preserving the efficiency of the sphincter ani muscle, provided the growth is removable by the low route

That when the combined method is used, an immediate abdominal anus should be formed unless the continuity of the natural passages can be restored with exceptional facility

That institution of a colostomy at a previous operation is an embarrassment rather than an aid

THE DIAGNOSIS AND PROGNOSIS OF TUBERCULOUS AND SEPTIC CONDITIONS OF THE KIDNEY

BY GEORGE E ARMSTRONG, M D,
OF MONTREAL, CANADA

COMPARATIVELY recent and more exact methods of determining the organic changes in and functional values of the kidneys together with the experimental researches of Hanau, Baumgarten and his pupils, Hansen and Guani, as well as those of Wildbolz, have added materially to our knowledge of the diseases of these organs and to our therapeutic resources. The kidneys are, in the majority of cases, the first of the urinary organs to be infected by the tubercle bacillus. That one kidney alone may be affected at first, the other remaining free for a considerable time is a fact established by a large number of observations. It is with these cases of unilateral renal tuberculosis that we as surgeons are chiefly concerned, and this class includes according to Garré and Erhardt about 10 per cent of the tuberculous diseases.

Between June, 1905, and February, 1908, I removed 11 kidneys, 8 of these were tuberculous and 3 were cases of non-tuberculous pyonephrosis. Five of the patients were females and 6 were males. Of the 8 tuberculous cases 5 were males and 3 were females. The age in the tuberculous cases was from 21 to 41, the other 3 cases were aged respectively 48, 49, and 55.

The first symptoms in 3 of the 5 males were vesical tenesmus, frequency of micturition and hæmaturia. In one, frequency with pain but without blood, and in one, a sudden stoppage of the stream, followed by frequency. In the 3 women the first symptom was pain in the loin. Loss of weight was never a conspicuous symptom, although one patient had lost 30 pounds. Cystitis was present at the first examination in 6 cases, in 2 it was confined almost exclusively to the half

* Read before the American Surgical Association, May 5, 1908

of the bladder on the diseased side In 4 cases there were present at the first examination a distinct ulcer around the ureteral opening in the bladder on the diseased side In one case the ureteral opening in the bladder was swollen and œdematous, but not ulcerated Tuberculous epididymitis was present in two cases The relative dates of the development of the disease in the kidney, bladder, and testicle could not be determined

The diagnosis was made in each instance by examining the individual separate urines from each kidney, and finding tubercle bacilli in the urine from the diseased side This examination was also made to demonstrate the presence of a second kidney and the functional value of each kidney separately The findings in 4 of these cases have been published in the "Montreal Medical Journal," and are referred to by Dr R P Campbell in his paper published in the ANNALS OF SURGERY The details of the remaining 4 cases are as follows

A B, aged 29, English cotton-mill operative, married Was admitted to the Montreal General Hospital for pain in the right loin of 6 or 7 weeks' duration Slight at first and of a dull, aching character, it gradually became worse and compelled her to give up work She had lost in weight Her nutrition was poor—mucous membranes pale In the right loin was a mass which could be easily palpated and which was, apparently, an enlarged prolapsed kidney somewhat tender on pressure Amount of urine excreted in 24 hours 32½ oz It was found impossible to catheterize the right ureter The urine from the left kidney was drawn by a ureteral catheter, and that from the right was obtained from the bladder From the right kidney came only pure pus, in which no tubercle bacilli could be found Around the orifice of the right ureter was an ulcer The urine from the left kidney was as follows

Left Kidney	
Sp gr	1015
Reaction	Acid
Urea	8 grs to 1 oz
Alb	Trace
	Sugar present after pilordrin
	No tubercle bacilli
	Cocci

The right kidney and ureter were removed and the patient made an uninterrupted recovery. A year afterwards she was confined in the Montreal Maternity Hospital, when an examination of the bladder was made and the ulcer was found completely healed. The woman seemed in perfect health. The removed kidney was large, with scarcely any renal tissue left. It was composed of large pockets filled with pus. The pathologist's report was "Tuberculous pyonephrosis."

The 6th case W J K, aged 41—Complained of frequency of micturition. Had had appendicitis 18 months before, and the appendix was removed. His first symptom was in the fall of 1906, when a sudden stoppage of the stream was noticed, but it soon started again. Pain sometimes felt in the penis and the bladder, with increased frequency day and night. Has never noticed blood in the urine, which, however, has gradually become muddy and thick. During the summer of 1907, felt a pain in his loins. Has lost in weight. No history of fever or night sweats. Cystoscopic examination shows acute cystitis over the left side of the bladder with mucopus and doubtful-looking tubercles, more especially about the left ureteral orifice, which is very red, wide open and irregular in shape, slightly ulcerated, and in normal position. The right orifice is normal and the right side of the bladder is almost quite healthy in appearance. The bladder holds 6 oz with difficulty. Neck of bladder bleeds quite easily. Ureters were catheterized and the urine gave the following analysis:

	Right Ureter	Left Ureter
Reaction	Acid	Alkaline
Color	Clear, yellow	Pale, watery
Sp gr	1026	1006
Urea	29 per cent	6 per cent
	Blood cells (traumatic)	Numerous tubercle bacilli
	No pus	Pus in quantity

The kidney was removed on January 31, 1908. Adhesions were considerable. The kidney was enlarged, rough in appearance, and the capsule adherent.

The 7th case, Mrs J S C, aged 33, married, has had 2 children. Pulmonary tuberculosis diagnosed in March, 1905. Pain in the left kidney about the same time. Never had any

hæmaturia Pus in the urine was first discovered in April, 1906
The examination of the urine gave the following.

	Common	Right	Left
		15 c c	5 c c
Color	Turbid	Slightly cloudy	Bloody
Reaction	Acid	Acid	Alk
Sp gr		1018	Not taken
Urea		2 per cent	No urea
Albumin	Alb †	Tr	Alb †††
Pus	Pus	A few cells	Almost pure pus
Tubercle bacilli	Tubercle bacilli present	No tubercle bacilli	Tubercle bacilli present
Staphylococci		Staphylococci	

On palpation the left kidney was found to be enlarged to nearly the size of a child's head and tender on pressure. The pulmonary lesion is reported to be perfectly healed. The discomfort in the left side is considerable, and the bladder irritation extreme. Micturition sometimes as often as every 20 minutes, and as often as 20 times in the night, accompanied by pain and occasionally a speck of blood.

I removed the kidney and the patient made a very smooth and uninterrupted recovery. In 4 weeks the pain associated with micturition had entirely disappeared and the intervals had increased to 3, 4, and sometimes 5 hours, and on one occasion 6½ hours.

The 8th case, M W, female, aged 30—Early symptoms simulated nephrolithiasis. An examination of the urines at this time, September 17, 1907, gave the following

	Right Ureter	Left Ureter
	10 c.c.	10 c.c.
Sp gr	1012	1022
Reaction	Acid	Acid
Color	Straw	Blood
Urea	18 per cent	26 per cent
	Alb	Alb tr
	12 m nec to red 1 c.c. of Fehling	3 m nec. to red 1 c.c. of Fehling
	Δ—61	Δ—146
	Pus in quantity	No pus
	No tubercle bacilli	Red blood cells trace
	Large and small bacilli	

A diagnosis of stone was made and one of my colleagues did a nephrotomy. The pelvis and calices were dilated and a cavity was present in the upper pole but no stone was found. A sinus persisted and small perinephritic abscesses formed and were opened from time to time. The case seemed clinically to resemble very closely the condition described by Brewer as "Acute unilateral hæmatogenous infection of the kidney." On the 28th of November, 1907, the urines were as follows

	Right Ureter	Left Ureter
Sp gr	1012	1022
Reaction	Acid	Acid
Urea	6 per cent	2 per cent
	Pus	None
		A few red blood cells (traumatic)
	Δ —75	Δ —114

I removed the kidney on the 6th of December, 1907, and the pathological report was that it was tuberculous, the pyogenic infection being secondary.

The chemical reaction was in each instance alkaline. The urine from the diseased kidneys was never acid, in 3 the urine was alkaline and in 2 neutral. In 3 cases, only pus was obtained. As acid reaction is a characteristic of tuberculous pyuria and a neutral and alkaline reaction an evidence of mixed infection, it follows that in every case there was a mixed infection at the time of examination. A disagreeable odor was generally present in those that gave an alkaline reaction.

After establishing a diagnosis of tubercle in one kidney, it becomes necessary to estimate, if possible, the extent of the disease, the functional value of the kidney and also to demonstrate the presence of a second kidney and its functional value. In the very earliest stage it is often difficult to find tubercle bacilli. They may be few in number. In the late stages, when the kidney is little more than a pus sac they seem to have died out, and to be difficult to find in the pus coming from the kidney.

These results correspond closely with those of Ekehorn, who found bacteria relatively few in number in old cases in which the kidney after extirpation was found to be little more

than a pus sac with sclerotic walls and thin pus. The urine in such cases is very purulent and the bacteria few in number.

He reports a case of a woman 30 years of age who came into the hospital in 1902, with a diagnosis of tuberculosis of the left kidney. Numbers of tubercle bacilli were present in the urine—the disease was relatively recent. She was a strong able woman, and would not submit to an operation while she was free from pain. She left the hospital improved, and having gained 3 kilos in weight. In 1904, she was re-admitted to the hospital. During this period of 2 years she had worked hard and felt well. Her only complaint was of frequent micturition. The tubercle bacilli in the urine were few in number and the pus greatly increased in quantity. The extirpated kidney was found to be in a condition of fully developed tuberculous pyonephrosis with thin fibrous walls.

Another of his cases was that of a young woman aged 22, with tuberculosis of the right kidney. In June, 1906, after lifting a heavy load she suffered for a few days from a painful feeling in the right lumbar region. She felt the pain only when she bent forward or straightened up. It was not sufficient to prevent her from continuing with her usual work, and in a few days she felt quite well. On the 5th of October, 1906, blood appeared in the urine, and at the same time right renal colic—generally two attacks a day, each one lasting 15 or 20 minutes. This sometimes continued for a week, when she seemed to recover perfectly, and could do her work as usual. On the 16th of November blood reappeared in the urine, but without pain. There were no bladder symptoms. In the urine were found pus-cells and numerous tubercle bacilli with only a trace of albumin. The number of tubercle bacilli in this case was great, while the number of pus-cells was small with here and there a red blood-cell. Only 6 c.c. of urine came from the right ureter during an hour. The urine was not pale, but had a normal color. That from the left kidney was quite normal. The kidney was removed on the 23rd of November, 1906, and the extirpated kidney showed comparatively small changes. When the kidney was split it appeared for the most part sound. The chief changes from the normal were found in the three papillæ.

Ekehorn draws the following conclusions. Numerous bacilli may be found in the urine in very early cases and the number of bacteria found at different times vary during the different periods of the disease. When a new part becomes involved, the bacteria are more numerous. With numerous bacilli there may be a small quantity of pus and with a large amount of pus the bacteria may be relatively few in number. When the pus is in large quantity and the bacteria few, the lesion is probably an old one with cavities and sclerotic walls.

If the pus in the urine is insignificant, then it is probable that no very large part of the kidney is involved, although many bacilli may be present

The functional value of the diseased kidney is difficult to determine with certainty. A small amount of disease may materially lower its efficiency. This is very well shown in one of my cases where the kidney involved excreted urine turbid in color and neutral in reaction, sp gr 1007, urea 11 per cent, and only a trace of albumin—sugar present and a freezing point of -35° —pus and tubercle bacilli. When the kidney was removed nothing was evident on or beneath the capsule, nor, indeed, was it at first apparent after longitudinal section had been made from pole to pole. On a more minute inspection one calix was found where all the points of the pyramids projecting into it showed macro- and microscopically typical tubercle formation. Hæmaturia had been a prominent symptom in this case. The kidney was removed because the hemorrhages were so large and recurred so frequently that he was becoming decidedly anæmic.

To establish the diagnosis pus must be found as well as tubercle bacilli, as in patients suffering from pulmonary tuberculosis the urine may contain tubercle bacilli and yet at autopsy no alteration in the kidneys be found. This has been noted by Jani and Schuschar dt and others.

The determination of the functional value of the other kidney is of great importance and the results in my cases based upon an examination of the urine from this kidney have been found to truly indicate its efficiency.

LIEK, however, reports a case where such was not the case. The urines from the two kidneys in Liek's case were as follows:

Right	Left
15 cc	50 cc
Clear	At first turbid, later clear
Mildly acid	Alkaline
No sediment	Very rich in leucocytes
No albumin	Trace of albumin
After 0.01 Phloridzin after 20 min good reaction	After 22 min sugar reaction
Fr pt not taken	Fr pt -0.60°

From these findings it was concluded that the right kidney was sound

An operation was undertaken to remove the left kidney but the infiltration of the musculature was extreme, extended down to the true pelvis, and the kidney could not be made out. While searching for the left kidney the condition of the patient became so bad that the operation was abandoned and the wound tamponed. The patient died a few days later. At the autopsy, this right kidney, which had, seemingly, good functional capacity, was found very much enlarged, 3 or 4 times its normal size. After longitudinal section was made, the pelvis and calices were found very much dilated; the kidney parenchyma pale, yellow and containing many miliary abscesses. Microscopically it showed extreme changes about the parenchyma and interstitial tissue—cloudy swelling and necrosis of the epithelium, small-celled infiltration and miliary abscesses. As Lick remarks, the case would seem to indicate that these methods of determining the functional value of a kidney are only of relative value.

In a 21-year-old man suffering from rupture of the urethra and severe pyelonephritis of the left kidney, the right kidney gave a clear urine in sufficient quantity in typical intervals without sediment and without albumin. After the injection of 0.01 of phloridzin, good sugar reaction appeared in 20 minutes. The electric test seemed normal. From this examination the removal of the left kidney was considered. At the autopsy this, apparently, sound right kidney was found in a condition of extreme congenital deficiency and not sufficient to maintain the blood of proper density.

Descending renal tuberculosis would seem to be three times as common in women as in men. In 464 cases of Albarán, Facklam, König, Czerny-Simon and Vigneron there were 127 males and 337 females. The ascending form is confined almost exclusively to men.

The two sides are affected with almost equal frequency, although Kuster, after examining a large number of cases, thinks there is perhaps a little preponderance of involvement of the right side and suggests the association of this condition with floating kidney.

There can be little doubt that renal tuberculosis is seldom, if ever, really primary. If it is true that 90 or 95 per cent of all adults have, or have had, tuberculous lesions, it would certainly seem that the kidney involvement must be, as a rule, secondary to some glandular, pulmonary or other tuberculous lesion. Vigneron and Israel found secondary tuberculosis in

50 per cent of cases of so-called primary renal tuberculosis. The kidney lesion may, however, be primary clinically, that is, it may be the primary lesion in the urinary tract and the only lesion active at the time, yet a careful study of autopsies renders it doubtful whether it is not in reality always secondary.

The bacilli are generally carried^h in the blood-stream, although the kidney may be infected by extension from adjacent tissues, particularly the peritoneum, and one cannot deny that possibly the infection may, in some instances, ascend from the bladder to the kidney. The preponderance of descending or hæmatogenous infection is well established by the studies of Steinthals, and Simmond's autopsy reports. Clinically, the renal may be of a truly primary focus. Of the primary lesion there may be no evidence as to its situation or even of its existence. Baumgarten's experiments indicate that tubercle bacilli never go against the stream either in the blood or in the lymph-vessels. He injected a highly virulent pure culture into the urethra of rabbits and attempted in that way to produce a tuberculous ulceration of the bladder and prostate, but he never got the infection to spread up to the kidneys or the epididymis. To produce an ascending infection of the kidneys, it was necessary, after injecting the ureter with the culture of tubercle bacillus, to put a ligature around distal to the injection, in that way arresting the flow of urine. There was the same difficulty in producing infection of the epididymis from the bladder. Albarran, Bernard and Salomon had the same experience, failing to cause changes in the kidney by injecting tubercle bacilli into the ureter until retention of the ureter was artificially produced by ligature. To produce infection of the testicle, the testicle itself must be injected, and then infection may pass along the duct to the prostate. On the other hand, Wildbolz seems to have succeeded in infecting the kidney from injection into the ureter without ligature.

Clinically the other kidney may become tuberculous after the first one. In these cases there is sometimes present a tuberculous cystitis with perhaps a tuberculous ulcer around the ureteral opening of the first side affected. In these cases

Tuffier thinks that the infection of the second kidney is an ascending one. This view seems to have some support from the recent experiments of Wildbolz, but it is not supported by Albarran, Bernard and Salomon, whose experiments would indicate that the second kidney like the first is a descending hæmatogenous infection.

There is little doubt that the cystitis is secondary to the renal infection in the great majority of cases. Just how long before the bladder becomes involved I have not been able to determine. Ulceration in the bladder seems to begin just at the entrance of the ureter through the bladder wall where there is a moderate narrowing as if the bacilli were detained at this narrow point and there get in their work. These ulcers are sometimes distinctly crater-like.

In one of my cases the bladder was examined 3 years after the onset of symptoms. Cystitis and ulcer were then present. There had never, in this case, been any pain or frequency. In the second case, although cystitis and ulcer were present, there were no symptoms. In the third case, symptoms of frequency and pain had been present for 6 months, and in the fourth for 8 months, and in these cases the bladder symptoms had been among the first and most prominent throughout the illness. In the fifth and sixth cases there was no cystitis and no ulcer; in the seventh and eighth the cystitis was confined almost entirely to the lateral half of the bladder on the diseased side, and in one of them, No. 7, there was also present an ulcer around the ureteral orifice of that side. In both Nos. 7 and 8, the opposite half of the bladder and opposite ureteral opening were normal.

I do not think that in the cases in which the bladder symptoms were primary the kidney lesion had been an ascending one. In two of them the kidney, when removed, was very extensively diseased, being little more than a pus-sac. The bladder symptoms rapidly improved immediately after the nephrectomy, and in the third although the kidney lesion was small the bladder immediately recovered, and has remained well ever since.

It would seem that renal tuberculosis may remain comparatively latent for a long time, giving rise to few symptoms perhaps for years. In the eight cases upon which I have operated the disease in the kidney was obviously much older than that in the bladder.

Five of my patients were males and two of them had an associated tuberculosis of the epididymis. In both of these cases there was also present cystitis with ulcer around the ureteral orifice. The time of incidence of these two conditions is not known because we have no knowledge of the time when the cystitis and ulcer appeared. It is altogether likely that in these cases the testicular infection is also hæmatogenous.

In 4 of Israel's cases there was besides the renal tuberculosis a tuberculous epididymitis without any disease of the bladder.

The combination of tuberculosis of the urinary and genital organs in women is a rare occurrence.

Kuster thinks an ascending kidney tuberculosis is only possible by spreading from the mucous membrane or through antiperistaltic contraction of the ureters. This retroperistalsis has been observed, but it can take place only when there is a stricture in the lower end of the ureter analogous to the ligature applied by Albarran.

I have been unable to discover any predisposing cause in my cases. None of them had suffered from trauma, none of them admitted having had specific urethritis, in none of them was the condition obviously associated with floating kidney, and none of the kidneys removed showed any congenital lobulation or anatomical abnormality.

In 5 of these cases the kidney, when removed, showed very extensive caseation, breaking down of tissue in the centre and at both poles. In one the kidney was very hard and contracted, in one there was nothing outside of the kidney and but one calix where all the surrounding tissue was tuberculous, the disease spreading in the surrounding tissue to the depth of three-sixteenths to one-quarter of an inch, the whole disease

occupying about 9 c c of kidney tissue In this case hemorrhage was a prominent symptom

Zondek and Israel give an anatomical reason for the frequent involvement of the lower pole of the kidney, namely, the occasional existence of an artery springing direct from the aorta and going to the lower pole of the kidney so that the infection becomes localized

In advanced cases I have found the fatty capsule altered, and very much adherent to the capsule of the kidney and in one it was indeed very difficult to separate it from the kidney

Marked involvement of the ureter was present in two cases The etiology of the changes in the ureter may vary in different cases, but the explanation given by Aschoff seems to harmonize very well with the clinical findings Aschoff thinks that the involvement of the walls of the ureter is an ascending lesion, secondary to the ulcer in the bladder, the infection spreading upwards through the lymphatics from the ulcer at the ureteral opening in the bladder, the ulcer itself being a descending lesion

Some cases have been reported in which the infection seems to have spread along the mucous membrane of the ureter by direct continuity from the pelvis of the kidney In two of my cases all the coats of the ureter were involved In one it was thickened and shortened raising the cornu of the bladder and rendering catheterization of the ureter difficult, in the other the walls were soft and friable—the ureter felt unusually large and œdematous

Cases are reported in which ulceration of the mucous membrane of the ureter has been followed by cicatricial narrowing and even total obliteration

The question of the frequency of involvement of the second kidney is of great interest The following figures put together by Vigneron throw considerable light on this question In 322 autopsies the disease was unilateral in 132 or 41 per cent, in 326 operated cases the disease was one-sided in 198 or 60 per cent These figures speak in a general way of the accuracy of the findings during clinical examination and

the operating table By the time these people come to autopsy, it would naturally be expected that both sides would be involved in a much larger proportion of cases

In another case many of the symptoms of tuberculous disease of the right kidney were present, namely, pain in the right loin and along the course of the right ureter, pain and frequency of micturition and pyuria, the patient gave a typical reaction to tuberculin, and no sign of any other focus could be discovered Nevertheless no tubercle bacilli could be found in the urine She improved under rest and dieting, and I did not recommend operation

The temperature varies in these cases, and is generally elevated when ulceration of the bladder is present, but, as remarked by Garrè and Erhardt, it disappears almost at once after the kidney has been removed, although cystitis and the ulcer remain They conclude that the only view to take of this is that the temperature was due to absorption of infected urine by the ulcerated surface

There is nothing characteristic about the enlargement of the kidney in tuberculous disease The enlargement is moderate in ordinary cases when due to caseation and excavation in the poles of the kidney When a pyonephrosis develops the enlargement may be considerably greater When one kidney is diseased and does its work imperfectly the other may undergo a compensating hypertrophy and the enlargement from this compensating hypertrophy has been mistaken for enlargement due to the disease and the wrong kidney removed If ureteral catheter specimens are examined, this error can be easily eliminated

The examination of the bladder is of interest and shows that the disease is first located at the ureteral opening on the diseased side and later in the trigonum

In the diagnosis Garrè and Erhardt recommended palpation of the ureters through the rectum or vagina Here one feels a distinctly thickened ureter on the diseased side as a tender cord If all other methods of diagnosis fail, there remains exploratory incision and the treatment of whatever

condition may be found. The early symptoms, and indeed sometimes the later as well, suggest stone in the kidney. Colic may be present in both conditions, but pyuria is an early symptom in tuberculous disease, and a late symptom in nephrolithiasis, and later the pain and frequency in micturition is not such a prominent feature in nephrolithiasis as in tuberculosis. The duration of tuberculosis of the kidney may extend over a long period,—10 or 15 years according to Czerny-Simons.

The prognosis in renal tuberculosis is very bad when not relieved by operative measures. It would be interesting to learn the results of climatic and tuberculin treatment in a series of cases of early renal tuberculosis. With the knowledge at present available it would seem that nephrectomy is the safer and more conservative plan. As to partial nephrectomy, a careful examination of the kidneys removed has seemed to demonstrate that such an attempt must necessarily prove uncertain and unsatisfactory. The difficulty of locating the disease and removing it altogether even after complete longitudinal splitting of the kidney seems to us to be unsurmountable, and the literature contains many cases of this so-called conservative surgery of the kidney which have resulted in permanent fistulæ and subsequent nephrectomy. Bilateral disease, colic, hemorrhage, retention, or localized abscess are the conditions which Czerny and Israel consider to call for nephrotomy. These conditions demand a palliative operation. When one kidney is in a condition of pyonephrosis, but still secreting a urine of sp gr 1007 and 1008, while the other kidney secretes urine of the sp gr of 1010 or 1012, it is impossible to sacrifice any secreting tissue without imperiling the proper consistency of the blood. In such cases nephrotomy is justifiable. One must in undertaking nephrotomy under these circumstances be prepared to put up with the annoyance of a persistent sinus through which more or less purulent urine may pass.

In general, nephrectomy is the operation of choice if the disease is limited to one kidney, and is advisable not only to relieve the patient from that focus of disease, but to relieve

the good kidney from the extra work entailed by the diseased kidney. The contraindications against nephrectomy are absence or imperfect functional power of the opposite kidney, evidence of incipient disease of the other kidney as indicated by the presence of albumin, a few pus-cells with tubercle or other bacilli. Cases are reported in which after the diseased kidney has been removed the other has improved, the albumin and pus-cells in some cases disappeared altogether.

The kidneys have been removed in each instance with their capsule. In none of them was there any special difficulty, in none of them were there any adhesions to the vena cava, the peritoneum was adherent in one.

The ureter has, in each instance, been removed to the level of the brim of the pelvis or a little lower. I have adopted the plan suggested by Mayo and injected the distal end of the ureter with 20 min. of pure carbolic acid and then tied it. The recovery from operation has, in each instance, been satisfactory. There has been no operation mortality. The quantity of urine secreted is disturbed wonderfully little. The secretion during the 24 hours succeeding any operation is, as a rule, less than usual. In my cases the quantity increased day by day until the normal was attained. Hypertrophy of the remaining kidney has been noticed in some cases.

The subsequent history of these cases has been dependent very largely upon whether ulceration of the bladder was present or not at the time of operation. In my first case the patient recovered perfectly at the time—left the Hospital well, and I learned that he died some months afterwards of acute miliary tuberculosis. The second case a year after operation was still suffering from frequency of micturition, being compelled to get up 4, 5 and 6 times at night. Cystoscopic examination at this time showed that the ulcer present at the time of operation was still present, possibly not so deep, or quite so large, but not markedly changed. During the year his general health had improved, and he weighed more than ever before, but the washings were too painful to be carried out.

regularly. He was put upon tuberculin and given an injection every 10 days. Since then he has steadily improved. No examination has been made of the bladder since, but in my last letter from him dated March 21, 1908, he was passing an average of 50 to 55 oz a day. He can now go 3 hours at a time with ease, and sometimes 4 hours and is only up twice at night. This is the condition 15 months after the removal of the kidney. In another case where an ulcer was present the pain has all disappeared and the frequency of micturition is very much diminished. In still another 2 months after operation the pain and distress in urination and the frequency are not much less than they were before the kidney was removed. In this case, like the other, the passage of an instrument was so painful that the man refused to have it done. He is at present taking guaiacol, and if an improvement does not follow, I shall put him on tuberculin. These results are in marked contrast with the rapid and complete disappearance of pain and frequency after the removal of a nontuberculous pyonephrosis. In one such case all bladder symptoms had passed away completely 5 weeks after the kidney was removed.

The continuance of pain and frequency in these cases with ulcer raise the question if it would not be better to be more radical and to remove the whole of the ureter with the cornu of the bladder. This procedure, of course, adds considerably to the severity of the operation.

Tuberculosis of the genital organs or bladder may become an urgent reason for nephrectomy rather than a contraindication, the pain of the bladder and distress generally improving markedly after the kidney is removed. Early bladder disease will almost certainly recover as soon as the kidney is removed, and even extreme cystitis with ulceration around the ureteral opening may recover, particularly if the diseased cornu of the bladder itself is excised as recommended by Kummell.

The results obtained in renal tuberculosis are improving. Schmieden collected 201 cases of nephrectomy after renal tuberculosis, of these 142 or 71 per cent recovered, and 59 or 29 per cent died. During the last 10 years the mortality

has not been more than 24 per cent. Isiael reports 29 nephrectomies, of these 14 were primary with sound bladders; 11 recovered perfectly. Kuster had 11 permanent recoveries in 17 cases of nephrectomy, Schede 16 in 22 cases and Czerny 11 in 27 cases.

In conclusion I desire to express my appreciation of Dr R. P. Campbell's kindness and dexterity in catheterizing the ureters in the cases that I have reported.

TRANSPERITONEAL REMOVAL OF TUMORS OF THE BLADDER.

BY CHARLES H MAYO, M D,

OF ROCHESTER, MINN

THE general application of modern methods in the examination of diseases of the bladder has been of great value in making early diagnoses of tumors of this viscus

With the aid of the cystoscope, portions of growths are removed by snares, forceps, or by curettes, and then washed from the bladder for examination. The result of the microscopical examination when considered with the location and extent of the tumor as shown by the cystoscope enables the operator to choose a method which will offer the greatest possibility of cure to the patient.

Cystoscopic examinations should be made by means of fluid distention of the bladder, as small pedunculated papillomata will float out in the liquid when they might cling to the mucosa in air distention and thus be overlooked.

In the natural evolution of the surgery of this region, which is still far from being crystallized, many changes from former methods of treating diseases and their complications have become necessary.

When we consider Watson's statement that operations in 28.6 per cent of benign, and 46 per cent of carcinomatous growths of the bladder have been surgical failures, we can see the necessity for early diagnosis, and the choice of a method of approach so that radical operations may be the rule and not the exception.

The ordinary routes of attack have been the suprapubic, infrapubic, urethral, vaginal, or perineal.

The operative technic as made through the urethra, will naturally be chosen by those who become expert in the use of the cystoscope, but we believe that very few tumors will be eradicated by this route, and that it is not the best method.

for the general surgeon Watson shows that for an apparently simple procedure it is accompanied by a rather high mortality

Of the other methods, the suprapubic is the most commonly employed Through various abdominal incisions the bladder is opened in the Retzius space, great care being exercised to preserve the peritoneum intact By this route papillomata have been removed with 20 per cent mortality, carcinoma with 28 per cent, and sarcoma with 63 per cent, with early recurrence in over 20 per cent of cases either benign or malignant, as given by Watson who has collected a large series of operations, the work of many surgeons (ANNALS OF SURGERY, Dec, 1905)

Considered from an operative standpoint we must recognize the fact that surgical failures are common in all kinds of tumors of the bladder above the prostate Owing to the great tendency to recurrence as well as the possibility of a change in the character of benign growths, they must all receive radical treatment Therefore, it is not my purpose in these remarks to devote time to the various tumors of the bladder from a pathological point of view, nor to those advanced cases which require the complete removal of the viscus In this connection, we desire to call attention to the fact that the lymphatics of the bladder are few and inactive, which fact delays metastasis of malignant tumors, rendering them for a considerable period a local disease Carcinoma confined to the bladder may be looked upon as curable by operation

Clinically there occur first, tumors with a pedicle, second, those with a broad base of attachment to the mucosa, third, those which involve the whole thickness of the bladder wall

The latter variety may by continuity of tissue involve other organs, the prostate, ureter, urethra, or adjacent abdominal structures Very large areas of the bladder, two-thirds or more, can be resected and the remainder will regenerate and dilate to a considerable extent, often forming a very serviceable organ, as pointed out by Harris (ANNALS OF SURGERY, Oct, 1902)

In an effort to develop an operation which would render all parts of the bladder accessible, the transperitoneal method seemed to be the most favorable. Watson (ANNALS OF SURGERY, Dec., 1905) has considered the removal of the unopened bladder through such an incision. F. Harrington (ANNALS OF SURGERY, 1893) has reported a case of chronic disease of the bladder treated by the transperitoneal incision. As a rule, when used at all, the method has been one developed without previous plan, of necessity or accident at the time of operation.

We have not been satisfied with the ordinary suprapubic incision in operating upon large tumors of the bladder, as, while several cases did exceedingly well, in two instances of cancer, we not only failed to cure the local condition, but unfortunately transplanted the disease to the abdominal wall and space of Retzius.

The usual result of imperfectly removed cancer is not only that relief is temporary, but the growth of the recurring tumor is usually more rapid and the condition of the patient, if anything, is worse than before the operation.

After securing the most favorable general and local conditions possible, the bladder being cleansed and emptied, an operation is made after the following method:

Operation —The patient is placed in the high Trendelenberg position and a median incision made from the pubes upwards for six inches or more. The pelvis is well packed with gauze pads which hold the intestines in the upper abdomen. The abdominal incision is also protected by gauze pads. The bladder is caught by two tenaculum forceps lifted into the wound and opened by a two-inch median incision. The small amount of fluid in the bladder is absorbed with gauze and the incision is enlarged upward and downward until it is ample for the purpose. The tumors may be cut from the bladder with scissors and the denuded area burned with cautery.

Malignant growths involving the lower half of the bladder can be raised with tenaculum forceps and resected with a Pacquelin cautery. The area removed should include healthy

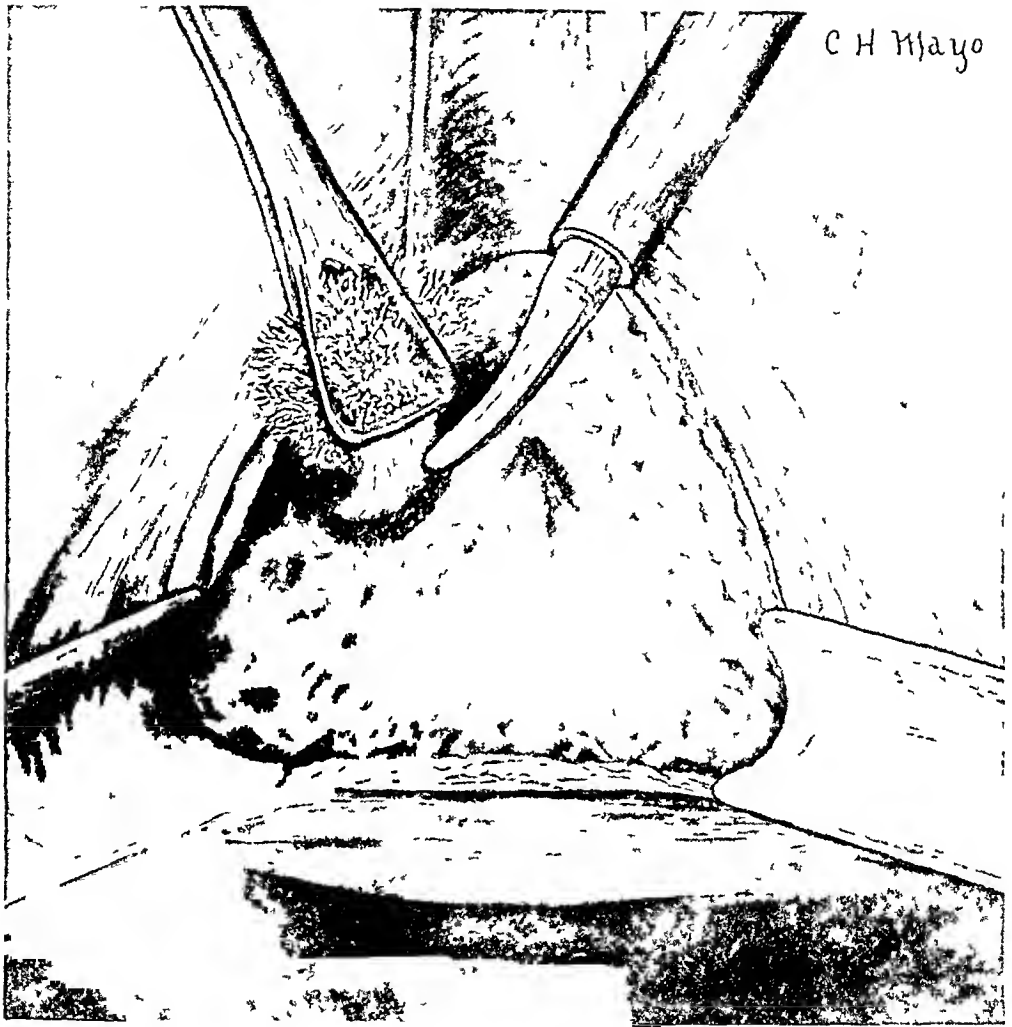
mucosa surrounding the tumor. No sutures are required to close these areas, the space being allowed to cicatrize.

When malignant growth necessitates the removal of a great part of the bladder, it is divided and removed freely, whether covered by peritoneum or not. In making the incision, one-third to one-half inch of tissue about the urethral entrance should be preserved if possible. If the bladder be involved at the ureteral opening, after the diseased portion of that viscus is removed, it is divided near the bladder and drawn into the abdomen through a perforation in the peritoneum close to the remaining half of the bladder, into which it is passed and where it is attached with catgut sutures. The peritoneum is closed over the exposed ureter in a fold by a few sutures, a method which insures rapid healing. The remaining portion of the bladder is now closed, often forming a greatly reduced but serviceable viscus.

The bladder wound, regardless of its size, is closed by a through and through continuous suture of catgut introduced in the original Connell method. This stitch is a running mattress suture and is passed through the entire thickness of the bladder wall, all loops pulling from the mucous side, and when drawn close, making a complete air-tight and water-tight continuous mattress stitch. The line of suture is now protected by a suture of silk, or preferably linen, applied as a Cushing parallel peritoneal suture, taking a square bite of the peritoneum first on one side then on the other of the line of closure, the needle being inserted parallel with the incision. This suture approximates the peritoneum and protects the primary suture just as when it is employed in gastrojejunostomy, and is used for the closure of all the bladder incisions and resections regardless of the amount removed.

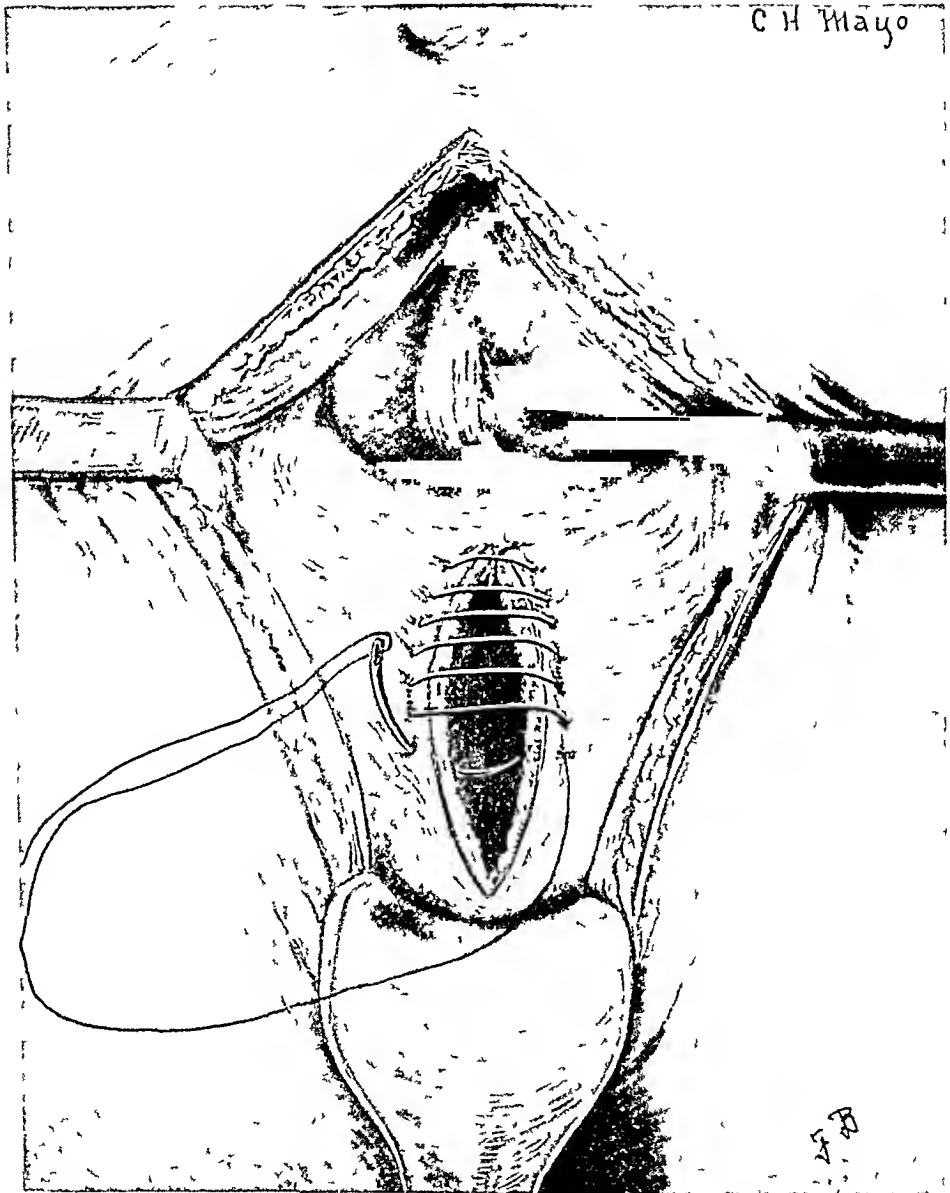
Should the bladder incision pass forward of the peritoneal fold, the closure will be the same, and is accomplished by drawing the bladder toward the abdomen and carrying the peritoneal fold to a lower level, the advantage of securing early peritoneal adhesions being developed to the fullest extent. As a rule the abdominal wound is closed without drainage, but

FIG 1



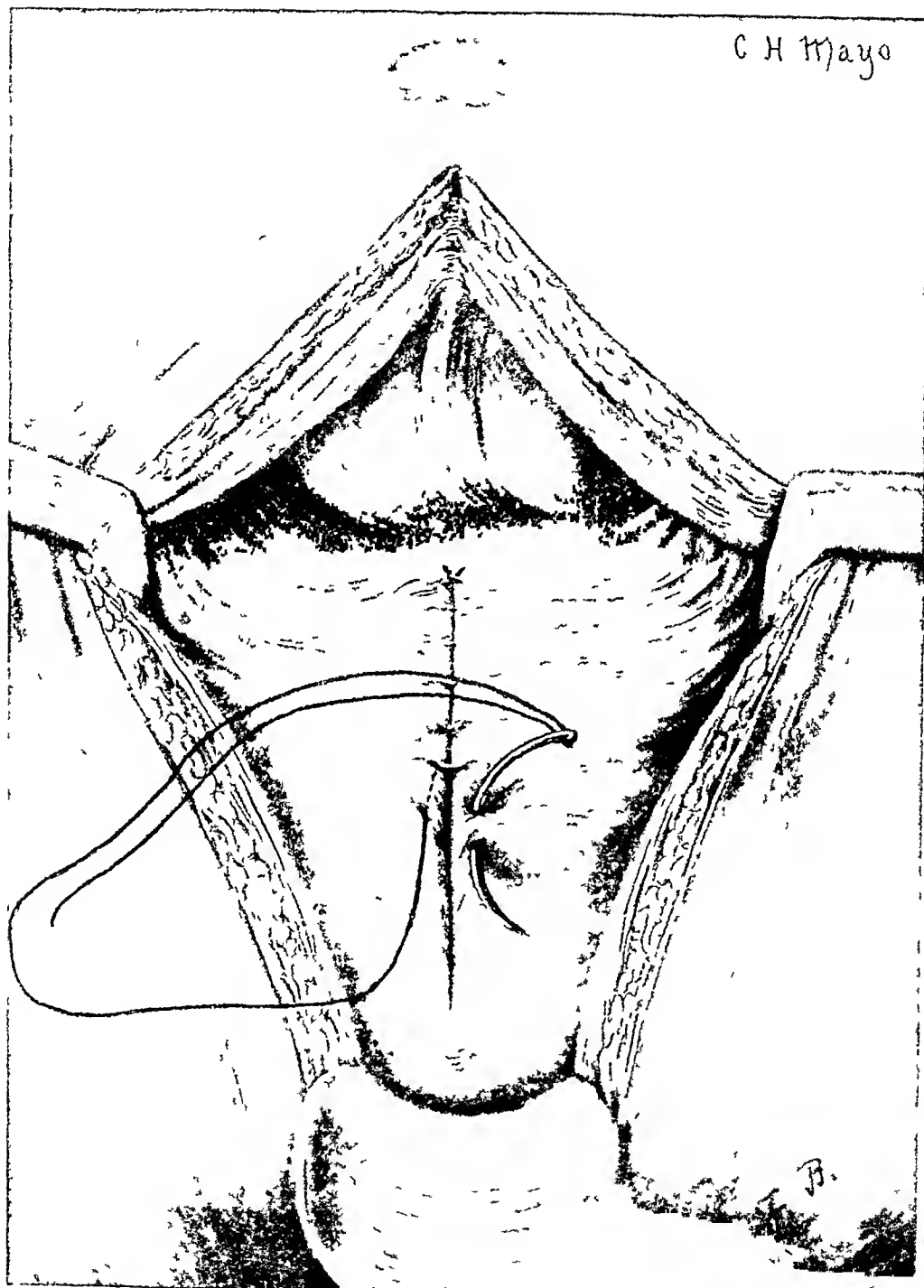
Cautery resection of papilloma of bladder

FIG 2



Showing method of closure of bladder incision

FIG 3



Cushing peritoneal suture closing bladder wound

FIG 4

C H Mayo



Removal of large amount of bladder with transplantation of ureter

should the general cavity of the peritoneum become soiled, a temporary drainage could be made through a stab-wound. The bladder is catheterized at regular intervals for the first few days following the operation, if it is necessary, but as a rule the patients void their urine at frequent intervals with little distress.

We have in five instances operated upon large papillomata of the bladder by the transperitoneal route, without mortality. Three of these tumors were carcinomatous, the others benign. A brief report of these cases is appended.

CASE I—Male, 27. Ten years with bladder symptoms and more or less blood in the urine. Large sessile base. Carcinoma left side of bladder. Operation, 3-27-'07. Transperitoneal resection of over one-half of the bladder with transplanting of left ureter into the right half of the bladder. Bladder drained by perineal incision. Voluntary urination with control of bladder after first three or four hours. In the fourth week all drains closed.

CASE II—Female, 39. Duration of symptoms two years. Blood in urine one year with much local pain. Cystoscope disclosed three tumors of lateral bladder wall, two small and one as large as a lemon. Operation, 5-1-'07. Transperitoneal with cautery resection of malignant papillomata. Bladder incision closed. Urine voluntary. Case well at examination after ten months.

CASE III—Male, 50. Duration of symptoms sixteen months. Blood in urine almost constant. Papilloma size of small orange. Benign. Operation, 6-14-'07. Transperitoneal, and excision with cautery. Bladder incision closed without drainage.

CASE IV—Male, 49. Slight symptoms two years. Blood in urine three months. Operation, 12-7-'07. Transperitoneal removal of sessile carcinoma size of walnut near base over left lobe of prostate. Four inches bladder resected with cautery. Prostate removed through same incision. Suprapubic drain. Voluntary urination with healed drains in three weeks.

CASE V—Male, 54. Duration of symptoms two years. Blood in urine one year. Tumor right wall, size of walnut. Operation, 1-8-'08. Transperitoneal resection, cautery.

AINHUM,

WITH REPORT OF A CASE *

BY EDMUND A BABLER, M.D.,

OF ST LOUIS, MO.,

Associate Surgeon, St. Louis Skin and Cancer Hospital, Assistant in Surgery
Medical Department, Washington University, St. Louis

ALTHOUGH practically half a century has elapsed since Clark, in a monograph read before the Epidemiologic Society of London, called attention to this peculiar disease affecting the natives of Brazil, the characteristic feature of which is the spontaneous amputation of the affected fingers and toes, it is true that we know very little concerning ainhum.

The disease has been observed in various parts of the civilized world, although only about twenty-four cases have been observed in the United States, the present case being probably the first one reported occurring in Missouri. The literature reveals the fact that the disease is very prevalent in India. The patient is usually a negro, not more than four cases have been reported in which the patient was a Caucasian.

The etiology of ainhum remains an open question. The researches of da Silva Lima led him to regard the disease as due to injuries to the toes, while Scheube contended that ainhum was a trophoneurosis. Zambaco Pacha believed the disease to be a lesion of leprosy. Wellman has recently stated that he agrees with McFarland, who said "The true cause of the fatty and atrophic changes in the amputated toe is not determined, it may be trophic, or it may depend on local cicatricial formation." In Wellman's opinion, the chigger may play an important role in prolonging the irritations and inflammations set up by wounds at the base of the toes. The probability of a parasitic origin has been scouted by many,

* From Surgical Dept., Washington University, Service of Dr. H. G. Mudd.

personally, I feel that time may prove the disease of parasitic origin. It certainly does not seem at all plausible that such a destructive process could be brought about by sharp grasses and the like, as has been long advocated by several observers. The fact that the disease has been observed in persons who have reached the meridian of life and who have worn shoes constantly since adolescence, tends, I think, to overthrow da Silva Lima's theory. Possibly we may find that uncleanness advances the development of the disease. Many of the theories that have been advanced by the early writers are quite preposterous. Dupouy has observed the occurrence of loin pains at the commencement of some of his cases, and the tendency of the disease to run in families.

Unna regards anhum as a primary degeneration of the epidermis. It is, in Unna's opinion, a sort of ring-formed sclerodermis, with callous formation of the epidermis, leading to secondary total stagnation necrosis. The horny layer is much thickened, and the papillæ are elongated and narrowed. In the papillary body, there is cellular infiltration, the papillary vessels are dilated, and the larger and deeper-lying vessels of the cutis and the hypoderm show obliterating endarteritis in different stages of development. The membrana propria is thickened. In discussing the pathology, Brayton says: "These are the progressive changes found in stagnated dermatoses. When the stratum corneum becomes thickened even in small areas, as in corns, atrophy of the underlying epidermis occurs. It is to be expected, therefore, that, with this hyperplasia of the epidermis and downgrowth of the interpapillary process, the corium should show an increase of fibrous tissue and fat, that owing to pressure there should be changes in the deeper blood-vessels and arteries, an increase of the adventitia or intima coats of the arteries so that the lumen is impaired, and finally obliterating endarteritis with slow gangrene. Eventually the constricting band approaches the bone, tumefaction of the toe occurs with stagnation of lymph and fat, gradually causing degeneration of all the constituents of the above tissue, pulp and cutis, a

condition of rarefying osteitis takes place, with final disappearance of the ungual phalanx, the partial disappearance of the second, and almost always the preservation of the third. The line of division may occur through the middle of the proximal phalanx or at the proximal interphalangeal articulation."

In our case, the patient's attention was first called to a small nodule situated on the dorsal surface of the little toe of the right foot, just at the edge of the phalangeal-metatarsal articulation. The nodule deepened and extended to the inner side of the little toe, eventually causing constriction, and the other clinical manifestations of the disease in question. The true pathology of antrum will continue to remain in question until the etiology of the disease has been determined.

The clinical manifestations of antrum are quite constant. The disease begins, as a rule, with a crack, fissure or nodule at the base of the toe on either the plantar or inner side. In our case, the patient's attention was first attracted to a small nodule on the dorsal surface at the base of the little toe, itching was present. The fissure deepens, gradually encircling the toe. Ulceration, bleeding and discomfort are seldom present. The distal portion of the toe becomes rounded and ball-like in appearance, it may be wider transversely than anteroposteriorly. The disease progresses very slowly, it may require ten years to completely sever the toe. Pain is seldom severe, in our case, however, the patient suffered so much at night that he could not sleep. The toe is frequently subjected to trauma.

Ulcers may appear late in the course of the disease. Palpation may be painful to the patient. When the bone has been destroyed and the toe is but loosely attached to the foot, the patient may complain severely of pain on walking. The distal portion of the toe may seem perfectly healthy, sensation may not be impaired. The medical attendant seldom sees these patients during the early course of the disease. In some instances the patient does not present himself for treatment until several of his toes have been spontaneously amputated.

PLATE I



D Babler's case of antrum

PLATE II.



Longitudinal section of toe Note constriction

The diagnosis is not difficult In Raynaud's disease there are preliminary lesions such as bullæ, vesicles, edema, etc , constitutional symptoms are present, the lesions are symmetrical In leprosy there are other manifestations of the disease, on other regions of the body pointing to the true character of the affection, preliminary manifestations precede the destructive process The mere fact that there is a constricting band at the base of the toe causing gradual amputation of the affected appendage should arouse suspicion

The prognosis depends upon the degree of destruction present at the time that the patient comes for treatment Conservative treatment has been unsatisfactory because the medical attendant does not see the patient early enough Linear incision and antiseptic dressings will probably suffice in the early cases Amputation is indicated when the disease has produced absorption of the bone The necrotic mass found in some cases should be evacuated and the sac walls swabbed with carbolic acid, then cleaned with alcohol, and dressed daily

Report of Case—James A , aged 50, a colored man, presented for treatment at the Surgical Clinic of the O'Fallon Dispensary, and gave the following history Born in Virginia, where he remained five years, then moved to Alabama, residing in the latter state for twenty-five years, moved to Tennessee, and seven years later he came to Missouri, where he has lived during the past thirteen years The family history is negative Patient has always enjoyed good health until nine years ago, at which time he contracted syphilis Three years thereafter, gummata appeared on both sides of neck About six years ago he suffered a paralysis of right side of face, appeared suddenly and has remained

About a year ago the patient observed a small warty-like growth on inner side near the dorsal surface at the base of the little toe of the right foot He removed it by means of his pocket knife Within a few weeks a similar but larger growth presented at the same side, and continued to grow , within three months it had partially encircled the base of the little toe. His attention has been frequently called to the growth owing to the presence

of more or less pain in the base of the affected toe. A singular feature is the fact that the pain has been worse at night. During the past five months the distal portion of the affected toe has been gradually assuming the appearance of a ball, the hard dense growth which has extended around the circumference of the toe has gradually produced absorption of the bone, the toe may be moved as though it was but slightly adherent to the foot.

Examination shows the usual findings in antrum. The reader is respectfully referred to plate I. Leprosy was readily excluded. The glands of the neck were found swollen and firm, not painful, evidence of frequent incisions. The right side of face is paralyzed. At the base of the little toe of the right foot is a semi-solid mass which presents the appearance of being a continuation of the destructive process observed in the little toe. Pressure causes pain.

Amputation of the affected, and practically destroyed toe, was advised. A few days later the toe was removed under a local anesthetic. At the base of the little toe, just internal to the phalangeal-metatarsal articulation, was found a necrotic, bloody-looking mass about as large as a small hazelnut, which led me to believe that the disease was extending to the ring toe. The parts were thoroughly swabbed with pure phenol and then with alcohol. The incised surfaces were apposed by means of sutures, and the parts dressed with moist bichloride gauze. Owing to the fact that the patient would not consent to enter the Washington University Hospital, he was compelled to return home, he placed more or less of his weight upon the right foot, thereby causing two of the sutures to cut out. At the end of ten days the parts had, however, healed. At present the patient can walk and work without discomfort.

Plate II is a beautiful reproduction of a longitudinal section of the diseased toe. The tissues on the inner side of the constricted portion of the toe were of such firm consistency that the microtome would scarcely cut through them. This is the first longitudinal section that I have seen in any publication. I am deeply indebted to Dr. Tiedemann for his kindness in making microscopic sections, and to Dr. H. G. Mudd for permission to report the case.

FIG 1



Arrest of growth at lower end of radius following fracture involving the epiphyseal line

ARREST OF GROWTH AT THE LOWER END OF THE RADIUS AFTER SEPARATION OF ITS EPIPHYSIS.

BY ADOLPH WAECHTER, M.D.,

OF NEW YORK

Instructor in Surgery in the New York Post-Graduate Medical School

MASTER R B, 11 years of age, sustained a Colles' fracture of the left hand by a fall two years ago. The hand was set and treated without any subsequent deformity or limitation of motion. As the boy grew older, his parents noticed a gradually increasing abduction of the left hand and a projection of the ulna. At the same time there was limitation of motion in some directions. They ascribed the deformity to the fact that the fracture had been improperly set. Upon examination, it was found that the hand was markedly abducted, adduction was absent, though flexion and extension were practically normal, supination and pronation limited. The radius was found to be one inch shorter than the ulna.

The X-ray examination shows two normally shaped bones, but the radius shorter than the ulna (Fig 1). The epiphysis of the radius is united firmly with the diaphysis in the centre by bony tissue. There being no distinct demarcation as in normal bones between epiphysis and diaphysis. The probable pathology is that, the cartilaginous portion having undergone bony changes, the osteoplastic function of the epiphysis is destroyed; as the result the radius is stunted in its growth, causing deformity. These changes of permanent ossification take place about the twenty-second year, but also can be brought about by irritation of the epiphysis, as has been shown by animal experiments. The latter may be the cause in this case as the result of improper immobilization of the fragments. Fractures of the epiphyses are very frequent in young people, especially in the radius, the latter being the most frequent form of fracture of the human skeleton next to the ribs. The injury is pro-

duced by a cross-strain, the limb having been bent beyond the normal limit or direction where there is no motion

P Bruns collected 81 cases of epiphyseal separations, with deformity as the result of retarded growth, the most frequent site being the femur with the radius following. Most cases occurred during the years of ten to nineteen

Among the 81 cases, there were 25 of retarded growth of the radius

Stimson, in his large experience, only saw 2 cases

The treatment of the above case is resection of the ulna in order to restore the functions of the wrist joint and correct the deformity

LITERATURE

Hoffa Ein fall von traumatische Epiphysentrennung mit folgender Hemmung des Langerwachstums Berlin Klin Wochenschrift, 1884

P Bruns Langenbecks Arch Berlin, 1881-2

P Bruns Die Lehre von den Knochenbrüchen, 1886

Davis Separation of an Epiphysis British M J, Lond, 1906

Stimson Book on Fractures, 1907

Hutchinson Dwarfing of the radius after detachment of the epiphysis in childhood Arch Surg Lond, 1892-93

Beck Fractures, 1900

STRAIN-FRACTURES OF THE KNEE.

BY SIDNEY LANGE, M D,

OF CINCINNATI, O

Radiographer to Cincinnati Hospital

THE Rontgen era has brought to light many strange and hitherto unsuspected types of fractures

Many of these recently discovered fractures are of the indirect variety, that is, fractures due to ligamentous or muscular strain rather than to direct violence. Such fractures were formerly diagnosed and treated as "sprains." To-day the diagnosis of "sprain" is justifiable only after a Rontgen examination has shown the absence of a fracture.

The most familiar type of fracture from ligamentous strain (indirect violence) is the Colles' fracture of the wrist. It is the purpose of these few lines to call attention to a type of fracture of the knee-joint produced in an analogous manner.

A glance at the anatomical make-up of the knee-joint establishes at once the possibility and plausibility for the occurrence of indirect or ligamentous strain fractures. The knee-joint is one of the most superficial and as far as adaptation of the bony surfaces goes, one of the weakest joints in the body, for in no position are the bones in more than partial contact. Its strength lies in the number, size and arrangement of the ligaments and the fascial expansions which pass over the articulation and enable it to withstand the leverage of the two longest bones in the body.

The strongest and most important of the ligaments that unite the two component bones of the knee-joint are (a) patellar ligament, (b) internal lateral ligament, (c) external lateral ligament, (d) posterior ligament, (e) crucial ligaments,—anterior and posterior.

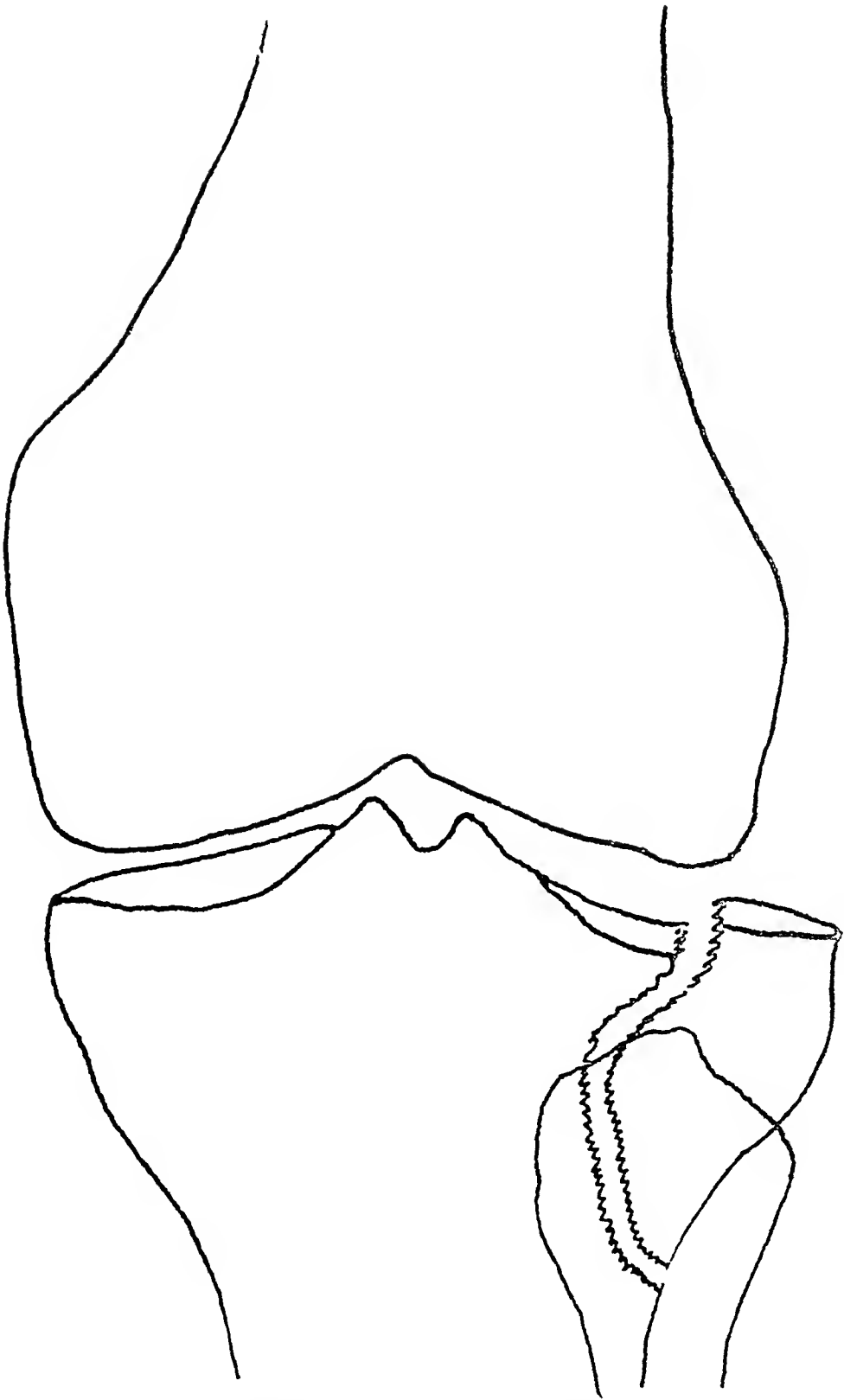
The patellar ligament is tense in flexion, relaxed in extension. Acting in conjunction with the anterior portion of the joint capsule, it limits excessive flexion. Sudden strain

in partial flexion frequently results in transverse or indirect fracture of the patella. The internal lateral ligament extends from the internal condyle of the femur to the shaft of the tibia below the inner tuberosity. It is tense during extension but relaxed during flexion. The external lateral is attached above to the external condyle of the femur. Below it divides into two portions, one of which is attached to the head of the fibula, while the smaller posterior portion joins the strong posterior ligament, to be attached to the outer tuberosity of the tibia. Like the internal, the external lateral ligament is tense during extension but relaxed in flexion. The lateral ligaments withstand the lateral strains upon the joint. They also check hyperextension and outward rotation.

The posterior ligament bounds the popliteal aspect of the joint and limits extension. The crucial ligaments play the most important part in maintaining the integrity of the knee-joint. The anterior crucial ligament is attached to the fossa in front of the spine of the tibia and to the anterior part of the ridge which separates the inner and outer tibial articular facets and is closely connected with the anterior end of the internal semilunar cartilage. The posterior crucial ligament arises from the fossa behind the tibial spine as well as from the space between the two tubercles which go to make up the tibial spine. It receives fibres from the posterior ligament and from the external semilunar cartilage. The crucial ligaments are inserted above to the mesial aspects of the inner and outer femoral condyles. They are more or less tense in all positions of the knee-joint, with the possible exception of flexion. They limit extension and (the anterior crucial) inward rotation. In conjunction with the lateral ligaments they prevent forward and backward sliding motions. Their function in flexion is somewhat unsettled. Treves insists that they become tense in flexion and thus limit over-flexion.

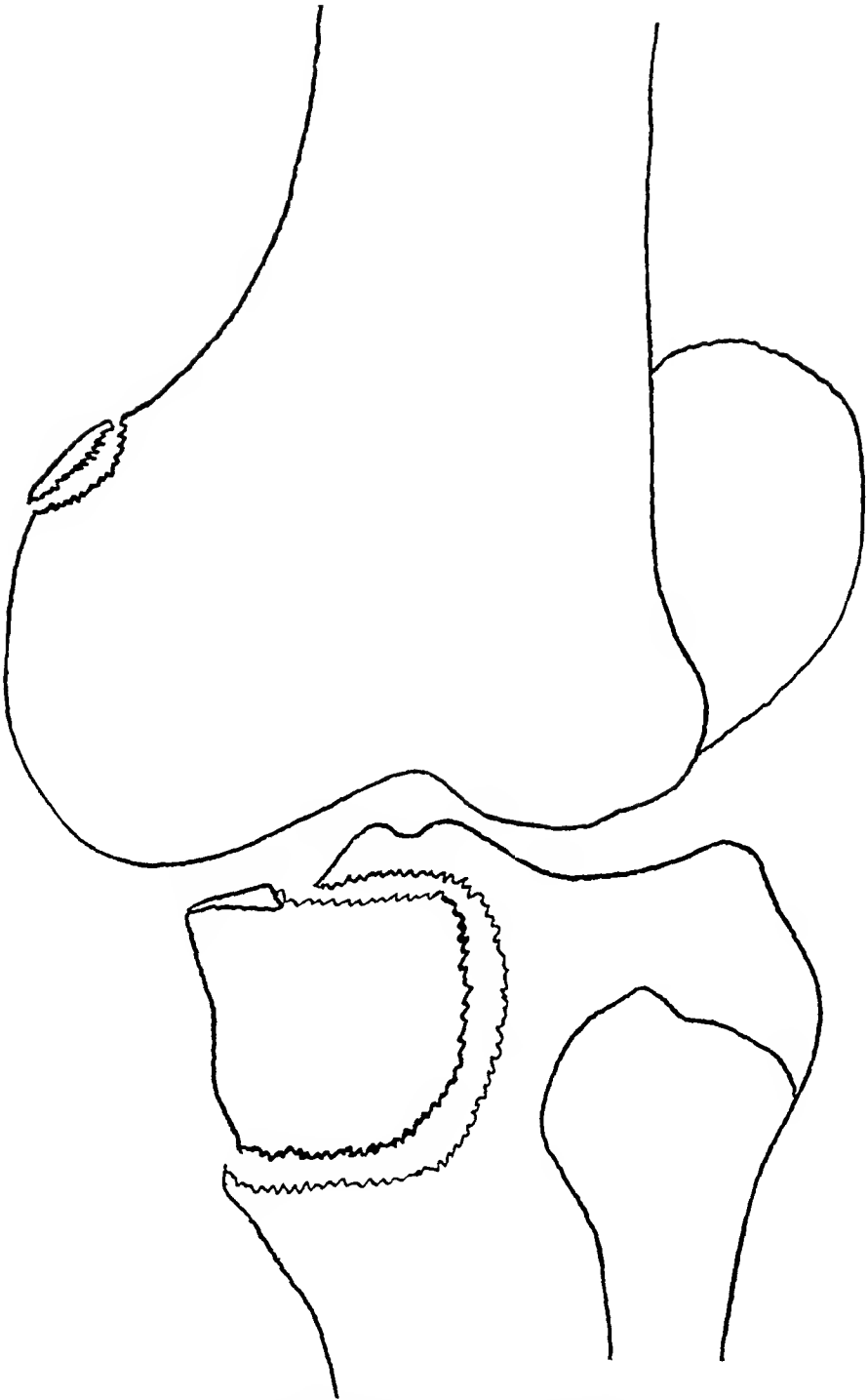
In studying the effects of strain upon the knee-joint in various directions, we may dismiss at once the flexion strain against the resistance of the patellar ligament and its subtended muscles, for we are well acquainted with the transverse

FIG 1



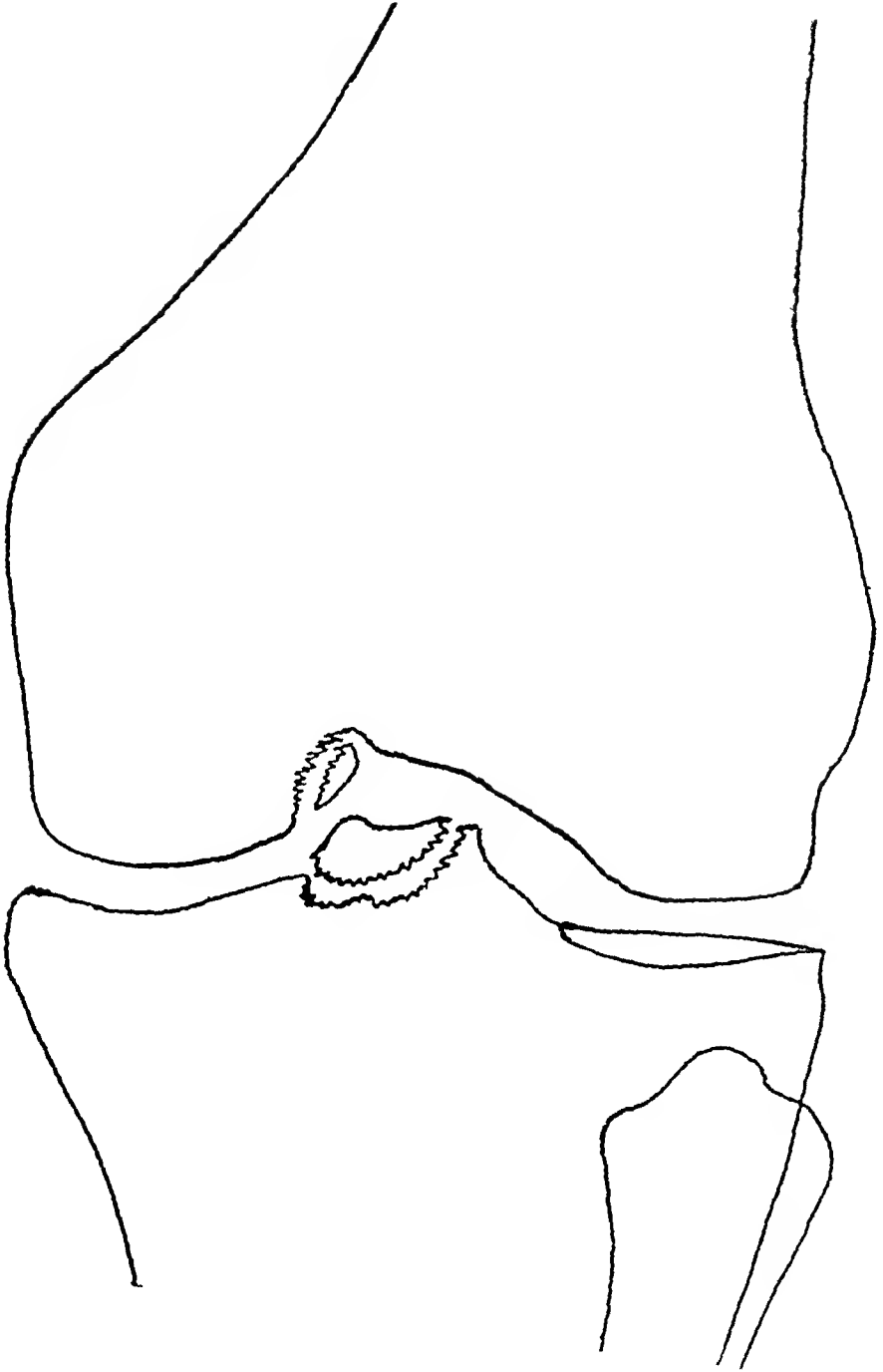
Avulsion of external tuberosity of tibia Outline from a skiagraph

FIG 2



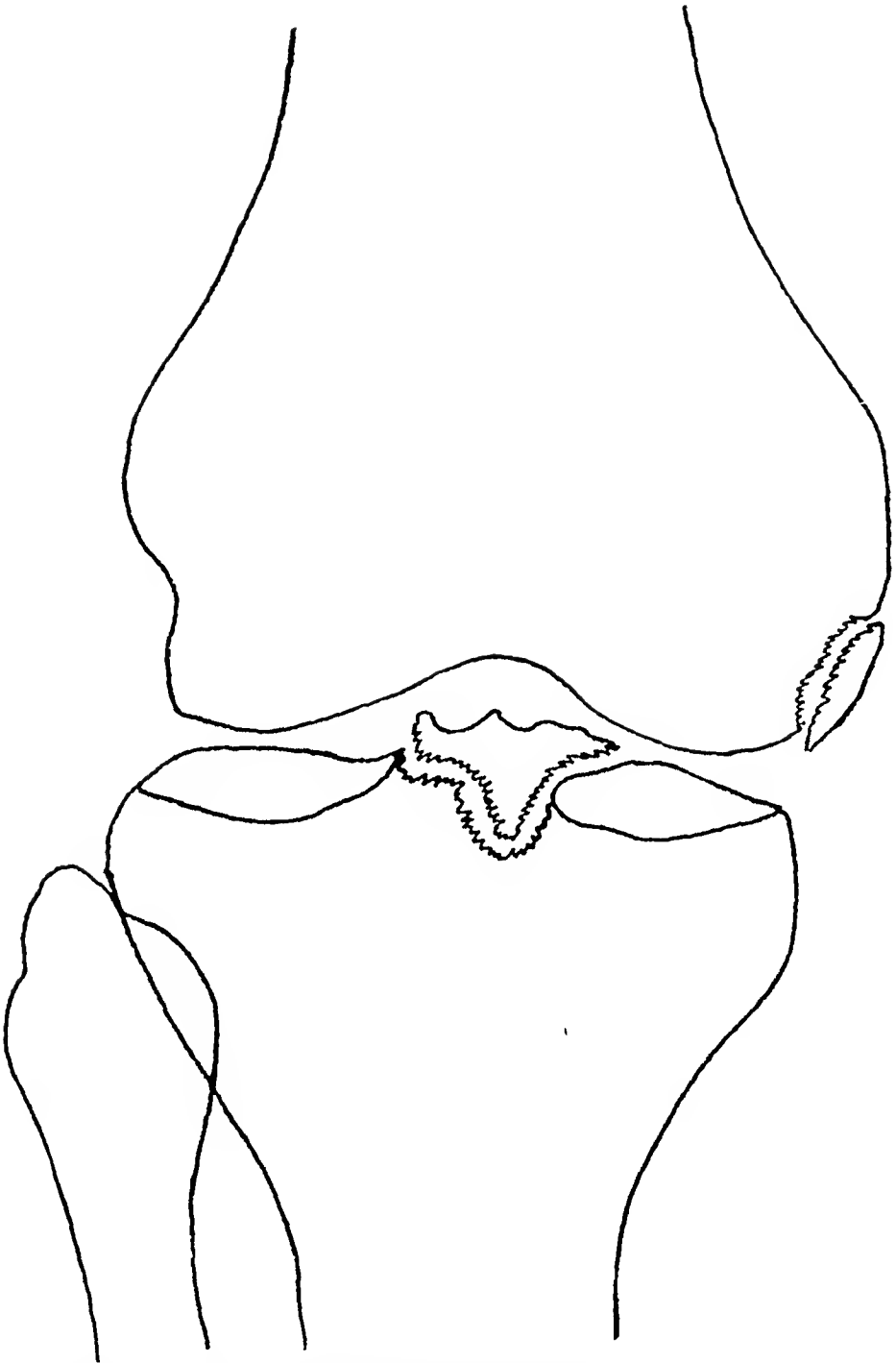
Avulsion of fragment from the internal tuberosity of head of tibia with tearing off of small scale from internal tuberosity of the femur Outline from a skiagraph

FIG 3



Crucial ligament fractures Outline from a skingraph

FIG 4



Crucial ligament fracture with tearing away of scale at insertion of internal ligament into femur Outline from a skiagraph

patella fractures which most commonly follow such violence

We have then to consider.

(a) Strain in the direction of hyperextension against the crucials, the posterior and the lateral ligaments,

(b) Strain exerted laterally against the internal or external lateral ligaments, the knee being in extended position, which puts these ligaments on the stretch,

(c) Strain in a rotatory direction, either in the direction of outward rotation, which is normally limited by the lateral ligaments, or in the direction of inward rotation, which is normally limited by the anterior crucial ligament

It should be understood that the above scheme is arranged simply for the purpose of discussion and that in any given case the strain will be exerted in several directions simultaneously

The following four cases served to call the writer's attention to the frequency of strain-fractures about the knee

CASE I (from the service of Dr J C Oliver) —Mr C W K While attempting to board a moving street car, the patient missed the car step, "twisted his knee," and fell to the ground He at once arose, experiencing only slight pain in his knee (right) and walked six squares when the pain became so intense that he was compelled to sit down in a neighboring drug store, whence he was removed to the Cincinnati Hospital *Examination of the knee showed no evidence of direct trauma to the soft parts* A skiagraph (sketch 1) showed a tearing off of the *external* tuberosity of the tibia, the line of fracture running into the knee-joint

CASE II (from the service of Dr J C Oliver) —Mr C L Patient was injured in a street car accident The left femur was fractured about two inches above the knee *The right knee showed no evidence of direct trauma* and exhibited no positive signs of fracture of its component bones, but the severe pain on manipulating the joint suggested the need for a Rontgen examination The skiagram revealed a tearing off of the *internal* tuberosity of the tibia as well as a small fragment off the internal condyle of the femur, evidently a strain-fracture (sketch 2)

CASE III (from the service of Dr C E Caldwell) —Mr McD while wrestling accidentally twisted his left knee and fell

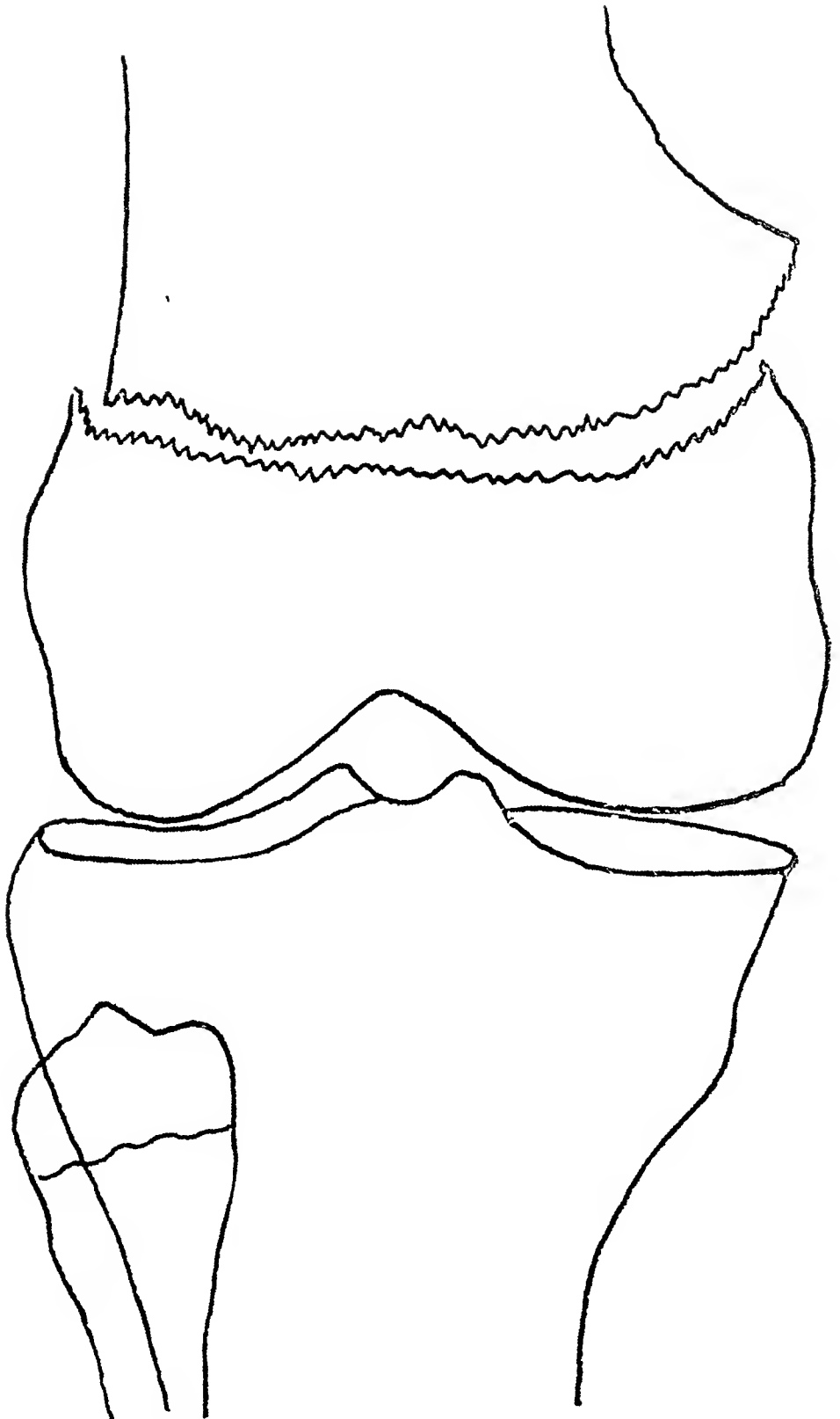
to the floor. He experienced great pain in the knee-joint but was able to walk to the hospital. Physical examination revealed a somewhat enlarged thickened joint but gave no positive evidence of fracture. A skiagram revealed a tearing off of the tibial spines (sketch 3).

CASE IV (from the service of Dr. Jos. Ransohoff) —Mr. J. D. while attempting to alight from a moving street car, twisted his left knee and was thrown violently to the ground. He was unable to arise, owing to the great pain in his knee. Physical examination showed *no bruising of the soft parts* nor evidence of fracture. A skiagram showed a tearing off of the internal condyle of the femur and an avulsion of the tibial spine (sketch 4).

In the above-cited four cases of fracture about the knee we have a history of a sudden and severe strain to the knee-joint with, upon physical examination, no evidence or bruising of the soft parts nor any of the usual signs of fracture. In Case I we may assume a lateral strain upon the knee from within outward, putting the *external* lateral ligament on the stretch, and then causing a tearing off of its tibial attachment (the *external* tuberosity of the tibia). In Case II we may assume strain in the opposite direction, which was exerted chiefly upon the *internal* lateral ligament, resulting in a tearing off of its tibial attachment (the *internal* tuberosity of the tibia) and also loosening a small fragment at the site of its femoral attachment (the internal condyle of the femur). In Case III the strain was borne chiefly by the crucial ligaments, resulting in an avulsion of the tibial spines at their base. In Case IV the strain was apparently felt first by the internal lateral ligament, which resulted in a tearing off of its femoral attachment (the internal condyle of the femur). This giving way of the internal lateral ligament apparently put the crucial ligaments on the stretch as evidenced by the avulsion of their tibial attachment (the tibial spine).

In studying the effect of knee strain by experimenting upon the cadaver, still another type of fracture by indirect trauma was brought to light. Figure 5, sketch 5, shows the result of lateral and postero-anterior strain upon the knee of

FIG. 5



Epiphyseal separation at lower end of femur Outline from roentgenograph (Fig. 6)

FIG 6



Skiagraph of epiphyseal avulsion at lower end of femur

the cadaver of a young adult. It consists in a complete epiphyseal separation of the lower end of the femur. It was produced by placing the cadaver in a ventrolateral position and bending the knee over the edge of the table.

It is more than probable that such a fracture may be produced in the living in an analogous manner.

The close relation between the crucial ligaments and semilunar cartilages (anterior crucial with internal semilunar and posterior crucial with external semilunar) indicates that strains upon the crucial ligaments will be felt by the semilunar cartilages and that dislocations of the semilunar cartilages may be accompanied by strain-fractures of the above-described type and vice versa.

Routine Röntgen examination of injured knee-joints will undoubtedly show strain-fractures of the component bones to be relatively frequent. The well-executed skiagram will render possible an accurate diagnosis of conditions that are too often vaguely termed "internal derangements of the knee-joint."

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

(Stated Meeting, February 26, 1908)

The President, DR JOSEPH A BLAKE, in the Chair

TRAUMATIC EPIDURAL AND INTRACEREBRAL HEMORRHAGE

DR BERN B GALLAUDET presented a young man who was admitted to Bellevue Hospital, November 27, 1907, with the history of having received a blow on the left side of the head the day before. He was not continuously unconscious, but almost immediately became aphasic. On admission to the hospital, about fourteen hours after having received his injury, he was aphasic and showed right-sided paralysis of the arm and face. An operation revealed a stellate fracture of the skull, with extra- and subdural hemorrhage, as well as hemorrhage into the brain cortex over the area indicated by the symptoms. The patient left the hospital a month after the operation, showing satisfactory improvement. There was still some facial paralysis, but he was now able to move the arm. His aphasia had also gradually disappeared, although he still hesitated in his speech.

OSTEOPLASTIC CLOSURE OF SKULL DEFECT

DR CLARENCE A McWILLIAMS presented a woman, 26 years of age, upon whom he had performed an osteoplastic operation for the covering of a skull-defect following a compound depressed fracture of the vault of the cranium, complicated by laceration and abscess of the brain. The patient was brought to the Presbyterian Hospital by the ambulance on May 6, 1907, and was admitted to the service of Dr McCosh, to whom Dr McWilliams was indebted for the privilege of operating upon the case. She had been struck by a trolley-car, and when found was unconscious, pulseless and bleeding from the nose and from a

compound comminuted depressed fracture of the left frontal region of the skull. From this large wound, cerebral tissue was oozing freely. The anterior extremity of the scalp wound was situated at the beginning of the hair-line in the left frontal region, and ran backwards about four inches, and from it several fragments of bone protruded. The patient was in coma, the pupils were equal and reacted to light, there was no subconjunctival hemorrhage, a partial paralysis of the right arm and leg could be made out, there was bleeding from both nostrils, but none from the ears, and there were some ecchymotic spots under the skin of the left mastoid bone. The knee-jerk was absent on the right side, but present on the left. Babinski reflex present on both sides. Death was considered certain in a short time. However, under energetic stimulation, the pulse became just perceptible in six hours. The wound was cleaned and several fragments of bone removed. Her condition remained so serious that it was 36 hours before it was deemed advisable to transfer her from the accident room to the hospital ward. The patient remained unconscious for about two weeks, during which time she was fed by gavage. The urine and feces were passed involuntarily, the catheter being passed several times indicated that the bladder remained empty. The wound suppurated, and on enlarging it a collection of two ounces of pus was evacuated from a cavity in the cerebrum. There was a marked tendency for the brain to protrude, with sloughing off of fragments of it. Three and a half weeks later, the patient was just able to say a few intelligent words, but she was stupid and somnolent. The right arm and leg were still partially paralyzed. Urine and feces are still passed involuntarily. A fragment of bone, one by one and a half inches long, was removed from the wound, and a second larger fragment was felt to be movable but somewhat attached. The wound was granulating, and there was a granulating area of exposed brain tissue, $1\frac{1}{2}$ in wide and 4 in long, spindle-shaped, with the long axis anteroposterior. Paralysis of the arm and leg remained the same.

On June 30, 55 days after the accident, the patient had been up and about for ten days. The function in the right arm and leg was returning. There was no facial paralysis. The bladder and rectum were functioning normally. Cerebration was very poor, the patient seeming unable to say connected sentences,

although there was no motor paralysis of speech Her memory was badly impaired

On July 9th, 64 days after the accident, she left the hospital to return for regular dressings for the granulating skull cavity She had almost entirely recovered from the paralysis of the arm and leg

Four months later, the process of granulation of the wound seemed almost at a standstill The epidermis had crept in at the edges, so that the bones were covered over and the skin was attached to the cerebrum At the bottom of the cavity was the pulsating cerebrum which was covered by granulating tissue, and which, by reason of its loss of tissue, was depressed about one half inch from the internal surface of the bones She was readmitted on November 4, 1907, to have the defect closed This was deemed possible only by turning in a flap from the sides, since it was thought that if any foreign substance was placed in the wound, it would have to be removed later because of the granulating surface of the cerebrum It seemed certain that the dura over the cerebral wound had sloughed away The operation was conducted as follows A piece of rubber tissue was placed over the defect, and a pattern cut out of it of the cavity, but one half inch larger than the same all around This pattern was then laid on the skin to the right of the edge of the cavity, and an incision was made along the edge of the rubber tissue down to the bone through the periosteum, but leaving a pedicle of about an inch posteriorly A chisel was then inserted along the incision line, the object being to chisel out a piece of the external table corresponding to the flap, and to raise it attached to the periosteum and skin It was found that it was impossible to raise the bone in one piece, but that it broke in several places However, the flap was finally turned in, so that the defect was entirely covered, there being on its under surface, several pieces of thin bone The cicatricial edges of the defect were cut away, and the edges of the reflected flap were sutured to the edges of the skin of the defect, a small place being left posteriorly for drainage The bare bone left by the removal of the flap was covered by some Thiersch skin grafts, taken from the thigh of the patient

The wound healed very kindly, and the result is shown in the accompanying photograph (Fig 1) There is some sinking in

FIG 1



Showing result after operation for osteoplastic closure of skull-defect

of the flap, due to the loss of cerebrum beneath. It feels quite firm, indicating that there is a bony foundation to the flap.

FRACTURED SKULL, WITH EXTRADURAL HEMORRHAGE

DR JOSEPH A. BLAKE presented a female infant, three weeks old, colored, who was brought to Roosevelt Hospital three days after birth (forceps delivery) with a history of convulsions since that time, and a right-sided facial paralysis. The latter was complete, involving the entire distribution of the nerve, and probably peripheral, while the convulsions were apparently due to some injury of the brain or its membranes. During one of the convulsions observed at the hospital the mouth was drawn to the left, the right eye was tightly closed, and the right hand and arm were drawn up. Subsequently, she had three convulsions that night and several the next day, all involving the same region.

There was a hæmatoma of considerable size over the left temporal region, and upon exposing the skull, a curved linear fracture was discovered, corresponding closely in situation to the squamous suture. Upon elevating the bone, several small clots were found underneath, these were removed, and the bone flap replaced. The child's general condition improved markedly after the operation, and she has had no definite convulsion since. There was at first an occasional slight twitching of the hand, but this disappeared after three or four days. There were still some evidences of her facial palsy.

CEREBRAL INJURY DUE TO A DEPRESSED FRACTURE OF THE SKULL IN AN INFANT

DR GEORGE E. BREWER presented a girl nine months old, who was admitted to the Roosevelt Hospital on January 2, 1908. Six days before admission she had sustained a severe injury to the left side of the skull by a fall from her mother's arms. When picked up the child was apparently dead, and it was some time before the respiratory movements were reestablished. Later it was noticed that the child did not move the right side of the body. She was kept at home under medical observation for six days. At the end of that time she was brought to the Roosevelt Hospital.

On admission the temperature was 101.5°, pulse 128. The child was apparently conscious, took and retained nourishment.

in abundance, and was not particularly restless. The right arm and leg were scarcely moved at all, while the left extremities appeared normal. There was a conjugate deviation of the eyes to the right, there was slight left facial palsy, the pupils were apparently equal and reaction normal. Examination of the head revealed an oblong swelling extending transversely across the mid-parietal region. This swelling was moderately elastic, and at the upper edge the bone could be felt distinctly depressed. On the advice of a neurologist the case was kept under observation for ten days, in the hope that the symptoms might subside without operation. On January 11th however, the condition being practically the same, the child was prepared for operation and a curved incision made over the left parietal region including the swollen area of the scalp. On lifting the omega-shaped flap of skin and soft tissues, there appeared to be a longitudinal fissure extending over a distance of nearly three inches across the centre of the parietal bone, which was joined near its anterior extremity by one extending upward toward the sagittal suture. The skull in the region of the longitudinal fissure was markedly depressed, and along the line of fracture there appeared a sausage-shaped mass of necrotic tissue about two and a half inches in length, and about three quarters of an inch in diameter. This mass appeared to be made up of dura and cerebral cortex, which had evidently been caught up by the depressed fragments at the moment of their greatest depression, and had been brought outside the skull by the spontaneous movement of the fragments towards their normal position. The upper fragment of bone which was most displaced, and which apparently caused marked cortical pressure was removed by bone forceps, also the depressed portion of the lower fragment. This exposed quite an area of the cortex, which was roughened and covered with a fibrinous exudate so that the shape of the convolutions could not be seen. The external necrotic mass was connected with the cerebral cortex by a flattened pedicle, which had occupied the fissure between the two depressed fragments. This was entirely removed, and as the condition of the patient was quite critical the operation was hastily terminated by replacing the cutaneous flap, and fastening it with two or three silkworm gut sutures. While this was being done, the child passed into a condition of complete collapse, pulse imperceptible, respirations entirely suspended. She was placed

in an inverted position, artificial respiration was undertaken, and the bowel partly filled with a hot salt solution. As a result of these stimulating measures, the child slowly rallied. An aseptic dressing was applied to the wound, and the child returned to the ward with a pulse of 160. Following the operation there was a sharp rise of temperature to 102° which however soon fell to the normal. The convalescence was uninterrupted, and she was discharged from the hospital ten days from the day of her operation. It is now twenty-five days since her discharge from the hospital. She appears in perfect health, and there is no apparent limitation of the movements of the arm and leg, the eyes are normal, and there is no evidence of facial palsy. The presence of a slight left-sided facial palsy, and the drawing of the eyes toward the right, would suggest some right-sided lesion. As it is quite evident that the depression of the fragments which occurred at the time of the injury must have been very great to have caught up such a large mass of cerebral tissue, it is easy to understand how such an injury might, by forcing the cranial contents violently toward the right, have caused some cortical lesion over the right motor area.

THE QUESTION OF OPERATION FOR NON-PENETRATING INTRACRANIAL TRAUMA

DR JOHN A HARTWELL read a paper with the above title, for which see page 25.

DR KILIANI said that in 1891 he reported a case of subdural hæmatoma with a free interval of 21 days. The man had received a blow on the head from which he apparently suffered no ill effects, but 21 days later his right arm became paralyzed. He was operated on on the twenty-fourth day after the receipt of the injury, and a subdural hæmatoma was found in the left motor area. Recovery was uneventful.

DR McCOSH said there was one point upon which sufficient stress had perhaps not been laid, and that was, the danger of future epilepsy after comparatively slight injuries to the head, and in cases where the early symptoms were perhaps trifling or even entirely absent. He always instructed his house surgeon, in dealing with cases of head injury in which there was any hæmatoma or any focal symptoms, to lay open the scalp and carefully examine the skull for evidence of fracture. The speaker

said he had learned from experience never to give a fatal prognosis in a case of fracture of the skull, he considered it a very unwise thing to do. The case shown by Dr McWilliams, when it entered the hospital, was apparently a hopeless one, and yet the woman had recovered.

PRIMARY CANCER OF THE APPENDIX NO RECURRENCE AFTER NINE YEARS

DR ANDREW J McCOSH presented a man, 34 years old, who was admitted to the Presbyterian Hospital on April 7, 1897. He stated that his difficulty began in the previous August, when he had sudden cramp-like pains in the right lower abdomen, accompanied by vomiting. These persisted about two weeks. During the following month he had a similar attack, lasting three weeks. He then remained well until the following March, when he was seized with sudden tenderness and pain in the right iliac fossa, with abdominal distention and vomiting. He was just recovering from this attack on his admission to the hospital, and an examination showed rigidity and tenderness in the right iliac fossa.

An indefinite mass was felt in the cæcal region. Upon operation no fluid was found in the abdomen. Just to the outer side of the right sacro-iliac there was a semi-elastic non-pulsating mass three and a half inches in diameter and an inch and a half in depth. It involved the cæcum and appendix synchronously, and extended apparently behind the posterior peritoneum. It was somewhat boggy to the touch, and an aspirating needle was introduced into it with negative results. It was regarded as a malignant tumor, involving the cæcum, appendix and peritoneum. Its removal was deemed impossible, and the wound was closed with drainage. The patient made a good operative recovery and left the hospital in good condition.

He was re-admitted on January 4, 1899, twenty months after his first operation, with the following history. For the past eight months he had had attacks of cramp-like pain in the region of the old scar. These attacks had latterly become more frequent. He had lost no flesh nor strength, there was no history of jaundice and the bowels were regular. There was a ventral hernia in the old appendix scar. Upon palpating through this scar there was felt at the usual site of the appendix a hard mass, about the

FIG 2



Spheroidal-celled cancer of the appendix. The muscular coats are arranged in a circular and longitudinal group, and scattered irregularly between the muscle bundles are alveoli filled with irregular ovoid or polyhedral cells with large nuclei. In other portions there is a diffuse infiltration of the muscle tissue with similar cells. There are no mitoses visible in the cells.

size of a hen's egg Upon operation, which was done on January 10, 1899, the intestines and omentum were found to be firmly matted together Several large hard masses were felt in the posterior part of the abdomen, which proved to be enlarged retroperitoneal glands The glands throughout the mesentery were also enlarged and hard The appendix was separated from the adherent intestines with much difficulty It was short and much thickened, and resembling an old chronic appendicitis It was removed, and the wound closed with drainage

A pathological examination of the specimen (Fig 2), made by Dr John S Thatcher, showed typical adenocancer in some of the sections A subsequent pathological examination was made by Dr F C Wood, who pronounced it a spheroidal-celled carcinoma of the appendix vermiformis Examination of the enlarged glands at the time of the operation showed them to be uninvolved by cancer The patient now 9 years after the removal of his appendix enjoys perfect health, and there is no evidences of a recurrence He has gained weight There is a hernia at the site of the scar which gives him no annoyance Dr McCosh had operated on another case of cancer of the appendix At the end of a year he was well, but since that time search for him has been in vain

DR OTTO G T KILIANI said he had seen two cases of primary carcinoma of the appendix One was operated on five years ago, and when the speaker lost sight of him, about eight months ago, there were no signs of a recurrence, and the patient was in good health The other was operated on about a year ago and was lost sight of Both were adenocarcinomata

PERFORATED ULCER OF THE DUODENUM

DR JOS A BLAKE presented a man, 43 years old, a horse-shoer, who was admitted to Roosevelt Hospital on December 13, 1907

For one year he had had gnawing pain in, above, and to the right of the umbilicus, occurring in attacks which had gradually increased in length and severity so that for four weeks before admission he had given up his work The pain was somewhat relieved by the ingestion of food and by vomiting He had never vomited blood, but for two months the stools had been tarry He had lost weight

The abdomen was somewhat scaphoid, symmetrical. There was a sensitive point above and to the right of the umbilicus. No mass was made out. Gastric analysis showed hyperchlorhydria.

At operation a mass was found between the first portion of the duodenum and the pancreas. The pylorus was not stenosed but was fixed to the mass on its deep surface. The mass did not appear to be carcinomatous, but on account of the lack of stenosis, the efficacy of a simple gastro-enterostomy seemed questionable and a pylorectomy was decided upon. This accordingly was done, but with the greatest difficulty for it was found that the lesion was a large ulcer which had perforated the first portion of the duodenum into the head of the pancreas. In separating the structures, the entire pancreatic wall of the first portion of the duodenum seemed to be deficient. Closure of the duodenal stump was well-nigh impossible but was finally accomplished by turning its lateral wall over and sewing it to the pancreas. So much time had been occupied by the operation that a button anastomosis was made. After the operation, there was considerable hemorrhage into the stomach owing to faulty hæmostasis, but with this exception recovery was smooth. A large drain of gauze and rubber dam was inserted to the duodenal stump and left in situ for ten days, leaving a large sinus which closed slowly. There was not, however, any leakage from the duodenum. He is now back at work without gastric symptoms and is gaining flesh.

PERFORATED GASTRIC ULCER. DIFFUSE PERITONITIS. PERITONEAL LAVAGE. CLOSURE WITHOUT DRAINAGE.

DR JOS A. BLAKE presented a man, 45 years old, a publisher, who was admitted to the Roosevelt Hospital on February 12, 1908. Four hours before admission he had had a severe attack of pain while hanging up his coat. He immediately collapsed and suffered agony until relieved by two hypodermics of $\frac{1}{4}$ gr each of morphine. He had suffered from indigestion for five or six years.

On admission his abdomen was scaphoid and extremely rigid. There was diffuse tenderness most marked on the right side. Liver dulness was absent.

Operation six hours after the perforation revealed an opening 4 millimetres in diameter situated immediately at the pylorus.

on its anterior surface. The gastric contents were escaping. The peritoneum everywhere in sight was injected and appeared swollen. The abdomen contained considerable quantity of guminous mucoid fluid.

The perforation was partially closed by a purse-string suture, but the suture could not be made secure until the duodenum had been folded over on the stomach, thus almost completely closing the already stenotic pylorus. The peritoneal cavity was then thoroughly washed out with a two-way irrigator, dirty fluid being returned from all parts of the abdomen. A posterior no loop gastro-enterostomy was then done by suture and the abdominal wound completely closed without drainage. Time of operation was fifty minutes.

The pulse came down a few beats as a result of the operation and he was returned to bed in good condition. His highest temperature, 101° , was reached on the third day and became normal on the fifth day.

Albumin water was given on the day after operation and on the third day he was given whole milk that had been coagulated with rennet, and the curd then beaten with an egg beater and pressed through cheese-cloth, there then being no possibility of large curds forming in the stomach. This form of milk, devised by Dr. Walton Martin, has been used with great success in several postoperative stomach cases and is far more palatable than peptonized milk.

PERFORATING GASTRIC ULCER

DR. JOS A. BLAKE reported this case, and showed the specimen. The patient was a housemaid, 21 years old, who was admitted to the Roosevelt Hospital on December 6, 1907. For six months she had pain rather characteristic of gastric ulcer, accompanied by vomiting. The vomitus had contained food and mucus, but not blood. She had lost between ten and fifteen pounds. Five weeks before admission she had noticed a small lump situated in the middle line of the abdomen above the umbilicus. This had grown steadily in size and had become tender. Upon examination, a hard tender mass, the size of a quarter, was found at the linea alba, one and one-half inches above the umbilicus. It was fixed, and apparently was partly superficial to and partly beneath the recti muscles.

The stomach analysis showed an increase in free hydrochloric acid

At operation, the mass was found to consist of a dense zone of reparative tissue thrown about a perforating gastric ulcer. The ulcer, one centimetre in diameter, had perforated not only the wall of the stomach, but the linea alba, its floor consisting of the new connective tissue felt beneath the skin. The ulcer thus formed a sort of tube two centimetres in depth, surrounded by a dense wall of fibrous tissue, one centimetre in thickness. There were no adhesions beyond this wall. The ulcer was situated in the anterior wall of the stomach, close to the lesser curvature, five centimetres from the pylorus. It was excised, the lines of excision crossing the lesser curvature and extending into the posterior surface of the stomach. After excision, the opening in the stomach was closed by an inner continuous suture of chromicized gut and a Cushing suture of silk. No further treatment was carried out, as the pylorus was open. Recovery has been uneventful and free from symptoms of ulcer.

DR HOTCHKISS enquired whether Dr Blake had noticed in these cases of operation upon the stomach, a tendency to non-union in the abdominal wound. He had had this experience recently in a case of perforated gastric ulcer in a very emaciated man where at the end of about a week the abdominal wound had burst open and this apparently was more from lack of reparative power than infection.

DR McCOSH said he could recall two or three instances where after stomach operations on semi-moribund patients, the sutures failed to hold, simply pulling through the tissues, and this without the slightest evidence of infection of the wound. When at the end of 10 or 12 days the silk sutures were removed there was an almost complete lack of repair and the wound edges fell apart. As well as he could remember operation in these cases had been done for cancer.

DR BLAKE thought the point brought up by Dr Hotchkiss was a very important one. He had noticed this absence of reparative power particularly in cancer of the stomach, since starvation was associated with cachexia. Under such conditions, it was now his practice to use a non-absorbable suture material.

DR KILIANI said that in his cases of cancer of the stomach he employed very heavy suture through and through material of

silk, for closing the abdominal wound he had found that other sutures were liable to tear out

TYPHOID PERFORATION OF THE ILEUM

DR WALTON MARTIN presented a woman, 42 years old, who was operated upon by him on November 6, 1907, at the Roosevelt Hospital in the service of Dr Blake, for intestinal perforation

The patient was admitted to the medical service on November 4th. Her statements were confused, and it was difficult to obtain a satisfactory history. Apparently, she had been ill for three or four weeks, having chills and fever and feeling prostrated and sick, but she was able during this period to do a little housework.

Three days before admission to the hospital, although feeling very weak, she attempted to cook dinner for her family, but while doing so, was seized with such severe cramp-like pains in the lower abdomen that she had to go to bed. Shortly afterwards she began to vomit and to have a diarrhoea. During the next day she became worse, and finally, three days after the onset of the severe pain, she sent for an ambulance and was brought to the hospital. On admission, the temperature was 100.8° , pulse 124, respirations, 32, leucocyte count, 6200, polymorphonuclear, 84 per cent, lymphocyte, 16 per cent. The woman looked ill. Her entire abdomen was slightly distended. There was no rigidity. It was more tender in the upper than the lower half. Spleen not felt. Vaginal examination negative.

The following day she had a chill lasting twenty minutes, the temperature rose to 104° , the pulse to 140. The leucocyte count was 7000, and polymorphonuclear 90 per cent. No malarial organisms were found in the blood.

The next morning her temperature had fallen to 100° , her pulse was 120, slight rigidity and tenderness were now present over the lower abdomen. She was transferred to the surgical division, an immediate operation having been advised.

Operation one hour later. Abdomen opened through a right intermuscular incision with an extension through the sheath of the rectus. The appendix showed secondary appendicitis of outer coats. There was gas in the pelvis. The coils of intestine in the lower abdomen were very heavily coated with large flakes

of fibrin The pus had the characteristic odor of colon bacillus pus The mesenteric glands were markedly enlarged On pulling up a piece of gut from the pelvis, there was a gush of fluid feces, that had evidently been bound in by adhesions about a small perforation in the small intestine, about $\frac{3}{8}$ of an inch in diameter It was punched out in appearance The heavy flakes of fibrin over the intestine made it impossible to say whether the perforation was in a Peyer's patch The tubes, ovaries and uterus were apparently normal The appendix was removed in the usual manner The perforation in the intestine was closed by a silk purse-string suture, reinforced with catgut Lembert sutures The abdominal cavity was carefully washed with normal salt solution A double drainage-tube was introduced to the bottom of the pelvis, and the abdominal wall closed about the tubes

The temperature after operation was 101° , pulse, 108 During the following night her temperature reached 105° and her pulse 140 A positive Widal reaction was present three days later, and about a week later one of her children, who had been living with her on a barge in the North River, was admitted to the hospital suffering from typhoid fever

The patient made a slow recovery, her convalescence being interrupted by residual abscesses, one on the left side, one between the bladder and a coil of small intestine, and one in the axilla In opening the median abscess the bladder was torn and although the tear was sutured, there was a leakage of urine for several weeks She is now in good health and rapidly gaining weight

The patient evidently had ambulatory typhoid, with a perforation of a coil of intestine situated in the pelvis The operation was performed five days after the onset of the severe abdominal pain

DR L W HOTCHKISS said he had seen a case very similar to the one reported by Dr Martin The patient was brought into Bellevue Hospital with the history of an illness dating back for some time Abdominal symptoms had developed a few days before Upon operation, a large encapsulated pelvic abscess was found in connection with a perforation of the small intestine There were no positive evidences of typhoid at the time, but the perforation was probably due to a typhoid ulcer Resection of the gut was done The case resulted fatally

DR BLAKE referred to a case presented by him at a previous meeting in which the typhoidal perforation was of three days' standing at the time of operation. In that case there was first a pelvic peritonitis which at the time of the operation had become general.

Stated Meeting, March 11, 1908

The President, DR JOSEPH A BLAKE, in the Chair

GASTRIC ULCER

DR ALEXANDER B JOHNSON presented a woman, 47 years old, who was operated on by him in 1899 for carcinoma of the left breast. The tumor was small, occupying the upper and outer quadrant of the breast, and there was no axillary involvement. Nine years had elapsed since the operation, and there were no signs of a recurrence up to the present time. About two and a half years ago the woman began to suffer from gastric disturbance. She did not vomit, but there was a continuous gnawing pain in the epigastrium. The gastric motility was not noticeably impaired, and there were no evidences of dilatation. An analysis of the stomach contents showed hyperacidity. Although there was no history of hæmatemesis, it was thought that she probably had an ulcer of the stomach. The patient had lost much flesh, and the pain was so severe that her sleep was disturbed.

Upon exposing the stomach, in April, 1907, an indurated area was found in its wall, about midway between the pylorus and the cardiac end, in the region of the greater curvature. This area of induration was oval in shape, measuring three inches in one diameter and two and a half inches in the other. There was a notable amount of fibrinous peritonitis which had caused the stomach to adhere to the neighboring intestines and abdominal wall. Near the center of this indurated adherent area there was an ulcer of the stomach, which was just about to perforate. The mesenteric glands were more or less enlarged. The entire involved area was excised, and the wound was closed. The patient made a good convalescence, and there had been no return of her acute symptoms, although the hyperacidity continued and she still had a certain amount of gastric dyspepsia. At the time of opera-

tion, the stomach was not found to be dilated, and there were no evidences of pyloric stenosis

The pathological diagnosis was chronic ulcer of the stomach. Around the ulcerated area, which was the size of a twenty-five cent silver piece, was a large area in which the mucosa and muscular wall of the stomach had been replaced by cicatricial tissue. There was no evidence of malignancy.

GASTRO-ENTEROSTOMY

DR ALEXANDER B JOHNSON presented a man, 43 years old, who was admitted to the New York Hospital on December 16, 1907, with the following history. Eighteen months ago he had first noticed belching of gas, bloating of the stomach, and vomiting of watery, sour fluid. He also complained of pain after eating, and a burning sensation located under the sternum and radiating to the sides of chest and shoulder. This was relieved by vomiting. Shortly after his initial gastric symptoms he had an attack of severe gastric pain. He was taken to the House of Relief, where the diagnosis of perforated gastric ulcer was made and confirmed at an operation which was done by Dr Tilton. Six weeks later the patient left the hospital, and remained well for three months, when his original symptoms returned.

Upon his admission to the New York Hospital he complained of pain in the epigastrium, with vomiting and loss of weight and appetite. An examination of the stomach contents after an Ewald test meal showed a total acidity of 87 per cent, with 38 per cent of free hydrochloric acid, there were marked traces of blood and lactic acid, starch digestion was poor. To the right of the middle line, and about three inches above the umbilicus a hard nodular mass was felt in the region of the pylorus. The stomach was markedly dilated, and gastric motility was much impaired. The case was regarded as one of stenosis of the pylorus from gastric ulcer, with much scar tissue in the pylorus, or of the same condition with secondary carcinomatous degeneration. Upon opening the abdomen the stomach was found markedly dilated. The pylorus itself and the stomach wall near the pylorus were hard and appeared to be extensively infiltrated with scar tissue. The appearances seemed to be the result of chronic ulceration rather than of malignant disease. A posterior gastro-enterostomy was done by the suture method and the short jejunal

loop Fine chromic gut was used for the inner row of sutures, and Pagenstecher thread for the outer Since the operation which was done on January 31, 1908, the patient had not vomited, he was on ordinary diet, and had had no gastric discomfort He had gained thirty-one pounds in weight He had resumed his work

DR BENJAMIN T TILTON, who had done the original operation for perforated gastric ulcer in the case shown by Dr. Johnson, said the operation was done about six hours after the perforation had occurred A small opening was found in the anterior stomach wall near the pylorus, and there were evidences of a beginning suppurative peritonitis The operation consisted in simply excising the involved area and putting in a few inverting sutures Subsequent to the operation, the man developed an attack of right lobar pneumonia, but otherwise made a good recovery

APPENDICITIS MISPLACED APPENDIX

DR JOHNSON presented a boy, 12 years old, who was admitted to the New York Hospital on January 26, 1908 The history obtained was that two days before admission he was seized with severe abdominal pain which was referred at first to the umbilical region On the day prior to admission the pain became general and had progressively increased in intensity The patient had vomited once, the bowels had moved to catharsis He had moderate fever and leucocytosis, with a relative increase of the polynuclear cells

Upon examination, the lower half of the abdomen was found to be quite rigid, the tenderness not being more marked on one side than the other The symptoms seemed to point to the appendix, although the tenderness was perhaps most marked just below the umbilicus The case was regarded as one of perforative appendicitis, with abscess formation and a probably spreading peritonitis

On making the usual abdominal incision, no cæcum nor ascending colon could be found, nor could the transverse colon be made out The case was thereupon regarded as one of those rare instances of failure of rotation of the intestines during fetal life, and a left intermuscular abdominal incision was made The small intestine was found to have a mesenteric attachment ending below at an unusually high point The cæcum lay to the left

of the median line at the level of the body of the fourth lumbar vertebra. The ileum entered the cæcum from right to left. From the cæcum the colon extended upward to the cardia of the stomach and then downward in one or two irregular coils, with a very short sigmoid, into the rectum. The very long appendix extended downward to the bottom of the pelvis in front of the rectum crossing it from right to left. The tip of the appendix was gangrenous and perforated. It lay in an abscess of moderate size surrounded by an area of fibrinous peritonitis. The appendix was removed in the usual way. The child made a good convalescence from the operation but on account of the great depth of the abscess a small sinus, now only one inch deep remained.

DR GEORGE E. BREWER said that about a year ago he saw a case very similar to the one presented by Dr. Johnson. The patient was admitted to the Roosevelt Hospital with symptoms of an acute abdominal inflammation, the whole lower abdomen being more or less rigid, but the symptoms being slightly more marked on the right side. When the abdomen was opened through a Kammerer incision the speaker said he was surprised to find only small intestine on the right side. Thinking this was due to an incomplete descent of the cæcum, he extended his incision upwards, but found nothing suggesting large intestine. Upon retracting the incision towards the median line he discovered the colon, and further investigation showed a perforated misplaced appendix.

DR JOSEPH A. BLAKE said he had seen two cases like those described by Drs. Johnson and Brewer, and he thought the diagnosis could best be made by carrying the exploration up to the duodenum. The cæcum could only be brought over to the right side by rotation of the gut, and when this failed to occur the mesentery was straight, and the cæcum remained in the median line. With incomplete rotation we would find the cæcum in close relation to the liver.

STAB WOUND OF HEART, SUTURE, DOUBLE LOBAR PNEUMONIA, EMPHYSEMA, THORACOTOMY, DRAINAGE

DR JOSEPH A. BLAKE presented a negro, 24 years old, who was admitted to the Roosevelt Hospital on December 13, 1907.

While drunk, about two hours before admission, he had been stabbed in the chest. He at first took little notice of the injury.

and walked a block, when he had to sit down on the curb on account of weakness. He was found by the ambulance surgeon in good condition but, on arriving at the hospital, became rapidly worse.

On admission, a stab wound, 2 cm long, was found over the fourth costal cartilage, a cm within the nipple line. The wound was bleeding moderately, and occasionally bubbles escaped. The area of cardiac dulness was increased. The heart sounds were inaudible, the radial pulse was barely perceptible and was irregular in force and rhythm.

A diagnosis of wound of the heart was made by Dr Dwight, the house surgeon, and Dr Blake was summoned immediately, reaching the hospital by the time things were prepared for operating.

The operation was performed under drop ether anæsthesia, about two and one-half hours from the reception of the injury. On account of the implication of the pleura, made evident by the bubbles escaping from the wound and the signs of fluid and air in the chest, he decided to open the pleural cavity, therefore, a rectangular flap was cut, embracing the third, fourth and fifth costal cartilages, and turned over the sternum, the cartilages being cut at the ribs and broken at their sternal attachments. The fourth costal cartilage was found to have been already divided. The pleural cavity was thus widely opened, disclosing a wound somewhat over a cm long in the pericardium, from which blood was flowing. The pericardium was then opened parallel to its attachment for a distance of 6 cm. It contained about two ounces of clotted blood. Close to the anterior coronary artery there was a wound in the right ventricle, one cm long, from which a small fountain of dark blood played for a distance of 10 or 12 cm at each systole. The hemorrhage was easily controlled by gentle pressure. The wound was closed with three interrupted sutures of fine silk, passing through the entire thickness of the ventricular wall, and there still being a little oozing, a Halsted mattress suture was placed over them. The sutures were introduced with some difficulty owing to the proximity of the coronary artery but, by grasping the heart fairly firmly in the left hand, its action was interrupted sufficiently to permit accurate insertion. The blood was then washed from the peri-

cardium and the opening in it sutured. The blood in the pericardium was clotted, but that in the pleura was fluid and amounted to about two pints. This was removed by sponging, and the flap was turned back, the wound being closed without drainage, excepting a piece of tape introduced into the stab wound, which communicated with the deep portion of the operation wound. The costal cartilages were sutured with chromicized catgut. There was no injury to the lung.

The pulse was steady after the operation, averaging 108, and was of good force. The temperature was subnormal, 96°. This was followed by a reaction to 101°. The next day the temperature averaged 104°; the pulse varied from 112 to 136, the respirations from 28 to 64. Signs of consolidation of the lower lobes of both lungs appeared, the temperature during the following week ranging between 102° and 105°. The operation wound healed by first intention, but the stab wound became grayish and sloughing. After the tenth day, the temperature ran lower, but was of the septic type, and pus discharged from the wound, the operation wound being partially opened to increase drainage. The heart's action was extremely good during all this period.

The pleural cavity, however, drained imperfectly through the anterior incision, and on the twenty-sixth day a portion of the ninth rib in the scapular line was removed, and a drainage tube inserted. This was followed by immediate improvement, and the lung gradually expanded, the sinuses finally closing. He was discharged on the fifty-ninth day in good general condition.

At present, three months after the injury, he was in good condition, although he felt the effect of the prolonged sepsis. The heart's action was regular, there was a friction sound. The wounds were completely healed.

REDUCTION OF FRACTURE-DISLOCATION OF SPINE AFTER LAMINECTOMY

DR CLARENCE A. McWILLIAMS presented a man, 34 years old, who was admitted to the Presbyterian Hospital on September 4, 1906, at 8 P. M. The history obtained was that at 1 o'clock that afternoon, while bending over and hammering some nails into a board, he was struck in the middle of the back by a heavy pile, which knocked him flat. He was unable to move afterwards,

and was brought from the Port Chester Hospital on an air mattress lying flat on his face

Examination showed an extensive swelling, the size of a large saucer, over the lower dorsal and lumbar region. It was evidently a hæmatoma, but under this was felt an irregular mass between the spinous processes of the twelfth dorsal and first lumbar vertebræ. The projection of the twelfth dorsal process was much more marked than that of the first lumbar. Palpation of the involved area was very painful, as was also any motion of it. There was a total loss of motion below the line of fracture. The soles of the feet were completely insensitive, and this extended up to the middle of the calves. Both popliteal spaces were somewhat hyperæsthetic, and pain and temperature sense was entirely absent over the back of both lower extremities. The plantar reflexes were absent. On the posterior thighs he could distinguish the prick of a pin from friction of the fingers, but he could not do so on the back of the calves. In the position occupied by the patient, no satisfactory examination of the anterior reflexes or sensations were possible. There was retention of urine, necessitating the use of catheter. No priapism.

The case was regarded as one of incomplete crushing of the cord, well suited for surgical intervention, and the patient was operated on at 11 P M., ten hours after the receipt of the injury. A four-inch incision was made over the tenth, eleventh and twelfth dorsal and first lumbar vertebræ, and a large amount of subcutaneous effused blood escaped. The finger could now be passed directly down to the spinal cord, between the eleventh and twelfth dorsal vertebræ as the interspinous ligament was torn. The muscles were cut away from the laminæ, and the spinous processes and laminæ of the eleventh and twelfth dorsal and first lumbar were removed. Bleeding was easily controlled by packing. The articular process on the upper left side of the twelfth dorsal seemed to be empty and was directed inwards and upwards, while the lower articular surface of the eleventh dorsal was resting just in front and above the articular surface on the upper side of the twelfth. On the opposite side of this there was a fracture which extended through the eleventh and possibly the twelfth transverse processes, internal to the articular surfaces. Several small fragments of bone were removed. The dura seemed uninjured, but was arched over the projection caused by the body of

the twelfth dorsal vertebra. A hypodermic needle introduced through the dura brought clear fluid, without blood. The dura was not opened. The dislocation was reduced by traction of an assistant on the patient's left shoulder, and traction by a second assistant on the pelvis and thigh, at the same time the operator exerted pressure on the opposite right lumbar region, the object being to rotate the man's trunk so as to separate the articular processes, if possible. This was finally accomplished by prying the edge of the eleventh articular process upward by means of a periosteal elevator. When this was done, the left shoulder was twisted posteriorly, and the edge of the articular process on the under surface of the eleventh rode over the upper edge of the articular process on the upper surface of the twelfth. Great force was necessary to accomplish the reduction. The muscles were then sutured, and a rubber drainage tube inserted. The operation, which lasted one hour, was well borne by the patient. Two long padded splints were placed along either side of the vertebral column, and bound down by adhesive plaster. Two muslin jackets were then placed around him. These pads were left undisturbed for six days, and during that period his temperature never rose above 100. On the sixth day a plaster jacket was substituted, and after this had hardened the patient was turned over on his back. His wound healed by primary union. Catheterization was necessary for nine days, the procedure each time being followed by a boric acid bladder irrigation, and urotropin was administered by mouth. At no time were there any evidences of cystitis. On the ninth day urination became involuntary, this was not the overflow of retention, for a catheter introduced on several occasions withdrew no residual urine. By the end of the second week he became conscious of the desire to urinate, but he could not retain his water when the desire came. The same was true of defecation. Constipation was absolute for several months. A week after the operation he began to have lancinating pains down the legs, and on the thirteenth day he could barely twitch the three left outer toes. The sensations of touch and pain had extended downwards to include all the surfaces of both legs, excepting the plantar surfaces, but was much less acute on the right than on the left side. On the nineteenth day he could move all the left toes and could flex the leg very slightly. The right toes could only be twitched slightly. On the thirty-fifth day he began

to contract the left quadriceps, the leg could be well flexed and the movements in the left toes were vigorous. The right lower extremity showed much return of power, but he could move all the toes slightly and there was an intimation of contraction of the right quadriceps.

On October 30, 1906, fifty-two days after the injury, a neurological examination was made by Dr J Ramsay Hunt. At this time slight flexion of the right toes and hip was possible, while on the left side the improvement was more marked. There were indistinct flexion and extension movements in the toes, ankles and knees. On both sides, knee and ankle jerks were present and exaggerated. On the right side there was ankle clonus, none on the left. Babinski on right, none on left. Tactile sense was impaired over both lower extremities. Pain sense was much impaired over both extremities, also the temperature sense.

The patient continued to gradually improve, and sat up in a chair on November 17, 1906, seventy-four days after the operation. On the ninety-fifth day he began using a walking machine, and on the one hundred and fourth day was able to get around on crutches. He left the hospital on December 21st, one hundred and eight days after the operation. For three months longer he used two crutches, and then for two months he used one crutch, which he at that time discarded for a cane. Neurological examination by Dr J Ramsay Hunt, on September 12, 1907, one year after the operation. Still has occasional shooting pains below the knees but gradually diminishing in intensity. Vesical function shows a little retardation but no incontinence. Sexual desire impaired but erections occur. Station is good. Gait typically spastic, the right leg showing a greater involvement than the left. Ankle clonus on both sides and bilateral Babinski. Abdominal reflexes present, left cremasteric present but right absent. The superficial sensations of touch, pain and temperature are diminished below the knees. The deep sensibility of the toes is well preserved. Stands and walks perfectly well without assistance.

Note, April 2, 1908, one year and seven months after the operation. The patient is able to rise from a chair and stand and walk without any assistance whatever. There is good movement and fair strength in both lower extremities but the gait is still typically spastic and shows a slight improvement over the

previous examination above Tactile sensibility is still diminished below the knees in both extremities He asserts that his erections are growing stronger and that he is able to have coitus about once a month His back is perfectly mobile in all directions and appears to have lost no strength The right leg is stronger than the left but somewhat more spastic

DR GEORGE WOOLSEY, who had seen the patient shown by Dr McWilliams prior to and at the operation, said it was very evident at the time that any reduction of the dislocation would have been difficult, if not impossible, without the open method Even by this method reduction was not easy to accomplish, and the case was an illustration of the fact that in similar cases of fracture-dislocation of the spine where radical interference is indicated, the open method is far easier and safer than any external manipulations Surgeons are not justified, of course, in operating on all cases, but when active treatment is indicated, operation is far better than manipulation

NEPHRECTOMY FOR TUBERCULOSIS OF THE KIDNEY AND URETER

DR GEORGE D STEWART presented a man, 39 years old, who three years ago first noticed that his urine was yellow, and looked as though it contained pus Urinated six to ten times daily Each urination was accompanied and followed by more or less smarting On physician's advice took infusion Buchu, condition improved Two years ago on return of same symptoms, he consulted a physician who treated him for nine months About this time he first noticed pain in his left side It was dull, persistent in character, most severe in bad weather Each attack lasted about a day, thought it was rheumatism He was cystoscoped and treated locally However he became gradually worse Began to lose weight Had attacks of chills, fever, and sweats at intervals, four in the last six months All of his other symptoms returned, except he states that the urine was clear, becoming, however, cloudy on standing

October 21, 1907 He went home and urinated before retiring Ten minutes later, he states that he passed a quart of urine, one hour later another quart At this time he noticed a lump in his left side, which was not painful, was movable and

about the size of an orange. He went to St Vincent's Dispensary the following day and was referred to the hospital.

Physical examination shows mass in the left lumbar region extending beyond median line. Above it disappears beneath costal margin, below extends into false pelvis, firm in consistency, not tender, movable with respiration, skin not involved, fluctuation not elicited. Amount of urine in twenty-four hours was 60 ounces. Color, amber. Reaction, acid. Specific gravity, 10-10. Albumen, moderate trace. No sugar. Microscopic, few red cells, few pus cells.

Operation, October 26, 1907. Incision from angle between erector-spinae muscles and last rib, forward towards crest of ileum, then directly forward to outer edge of rectus abdominis. Mass exposed found to be adherent to peritoneum and intestines, particularly the transverse mesocolon. Tumor dissected from diaphragm. The adhesions were difficult to tear, and in separating them an abscess was opened and contents escaped into the open peritoneal cavity, not invading the latter to any extent, however, as it had been rather carefully walled off with pads. The pedicle was tied and cut and the *ureter*, which was manifestly involved in the tubercular process and about the size of a finger, was cut beyond the pelvic brim. Because of the size of the large mass, considerable quantity of gauze packing was placed in the wound. Skin was sutured and entirely closed except at posterior angle.

Pathological Report of Dr Harlow Brooks. Microscopic examination of the greatly hypertrophied kidney removed shows practically the entire non-necrosed area to be made of a diffuse type of granulation tissue of low vitality, showing frequent areas of necrosis. Numerous tubercles are found scattered from place to place, but they are apparently of recent origin and seemingly younger than the accompanying simple inflammatory lesions. From this fact, one might surmise that the tubercular process was secondary.

Subsequent History.—Patient out of bed on twenty-first day, gained thirty pounds in two months, since operation has had no symptoms referable to kidneys, except that on two occasions he has had to rise during night to urinate. Examination of urine shows it to be normal with no evidence of tubercular bacilli. Recently the patient has had several small carbuncles on his back.

but they have not interfered with his general health or gradual increase in weight

Patient is presented to show the good results of a not too radical operation for kidney tuberculosis. In this instance a certain amount of the ureter involved in the tubercular process was left behind, and yet the patient shows neither local nor constitutional symptoms. It would appear that the tendency in recent years not only in genito-urinary tuberculosis, but also in the surgery of tubercular glands, joints, etc., has been towards conservatism and the outcome in this case adds, it seems, its quota of evidence in favor of such a course.

BENIGN STRICTURE OF THE ŒSOPHAGUS, GASTROSTOMY, DILATATION BY THE STRING METHOD

DR. GEORGE D. STEWART presented a man, 40 years old, who was admitted to Bellevue Hospital on February 20, 1907. His family and past history was negative.

About four months ago patient mistook a glass of washing soda for water, and drank some. Thinks he spat it all out at once, but not sure. Washed out mouth at once and drank water. For few hours after he had burning sensation at the level of the lower part of larynx. Ever since he has had pain in this region when he swallows also has had pain in epigastrium immediately after eating, and relief only after vomiting. Three weeks after taking the soda he began to vomit after eating. At first this was intermittent but increased in frequency. Sometimes the vomiting ceased for three or four days at a time. The vomitus was never large in amount, one to two cupsful at most, never sour, returned milk never clotted. No blood. Has lost 40 or 50 pounds.

February 27, 1907. On account of his extreme weakness a gastrostomy was performed according to the method of Senn.

Following his operation he gained 45 pounds in about six months. The gastrostomy was most efficient. Discharged September, 1907.

February 18, 1908. Patient was re-admitted to ward for the purpose of having his stricture treated. He had continued to gain in weight and was properly nourished. He also reported as being able to swallow a little water. An attempt was therefore made to get a string into his stomach by having the patient

swallow it, which was successful. The string after entering the stomach was washed out through the gastrostomy wound. With this fine string a larger silk one was drawn through the œsophagus. Then a bougie, about No. 28 French, was easily drawn through. Following this he was able to swallow, and since that time the bougies are being increased in size. The patient is now able to swallow perfectly, and has discontinued using his gastrostomy opening.

DR BLAKE said that in cases where the string could be introduced into the stomach by swallowing, it could readily be recovered through the gastrostomy wound by first throwing some water into the stomach and then sucking it out through a tube or catheter. If the string could be swallowed without difficulty, it was scarcely necessary to keep it permanently *in situ*.

DR F. KAMMERER said that by simply inserting a drainage tube through the gastrostomy wound of the patient in the erect position and instructing him to swallow water, the end of the string would come out through the tube. The speaker said that in tubular strictures, especially those of the cicatricial variety located near the lower end of the œsophagus, he had found that while dilatation with bougies was very simple to a certain degree, it was often impossible to dilate any farther, to a degree permitting easy deglutition. The stricture was very apt to become irritated and to re-contract. He had in mind one case where after cutting by the string method he had introduced bougies for eighteen months without accomplishing much more later on than had been accomplished almost immediately after the cutting operation.

DR CHARLES N. DOWD said that he had obtained excellent results by following the suggestion of von Hacker in stretching out a piece of rubber tubing and drawing it into the stricture. The steady pressure of the rubber quickly dilated a soft stricture to the stage where ordinary bougies could be used through the mouth.

DR KAMMERER said that he had tried the permanent rubber tube in the case he had just referred to, but it was not borne well by the patient, and apparently gave rise to irritation and fever. The ease or difficulty of dilating these strictures depended very much on the nature and size of the constriction.

INTERSTITIAL NEPHRITIS WITH MULTIPLE ABSCESS FORMATION

DR GEORGE WOOLSEY presented a woman, 28 years old, who was admitted to the Gynecological Service of Bellevue Hospital on January 6, 1908, complaining of headache, backache, nausea, pain in the abdomen, vaginal discharge and perineal weakness. She had a cystocele, a small rectocele, a retro-flexed uterus and a relaxed perineum. On January 14th Dr Barrows did a perineorrhaphy and a double Alexander operation, and the patient was discharged on January 30 in good condition.

She was re-admitted to the Surgical Division on February 5 with the history that during the night prior to her admission she had had a chill, followed by fever and nausea, but no vomiting. She complained of a severe pain in the right hypochondriac and lumbar regions, and stated that she had some cough, with blood tinged sputum. She was poorly nourished, and the physical signs at the apex of the right lung indicated tubercular trouble. There was marked rigidity of the upper right rectus and in the right lumbar region. On palpation, a very tender mass was felt below the right costal margin. This moved slightly with respiration. Her temperature on admission was 104, pulse, 140, respirations, 32. Leucocyte count, 15,000. The urine contained a heavy trace of albumin and a marked trace of indican. No blood nor tubercle bacilli, no casts. The patient micturated from two to four times at night; there was no frequency during the day. A cystoscopic examination made by the Kelly method showed that there was no congestion about the mouths of the ureters nor of the bladder generally.

Operation, February 14, 1908. When the abdomen was opened through a small exploratory incision through the right rectus the right kidney was found to be much enlarged. The other organs were apparently normal. The kidney was then fully exposed through a lumbar incision. The fibrous capsule was very adherent to the fatty capsule, and the former was torn in freeing the kidney. The kidney showed numerous elevated areas of lighter color and various size, round and oval, and softer than the main portion of the organ. A nephrectomy was done, from which the patient made an uneventful recovery.

A pathological examination of the removed kidney showed it to be the seat of an acute interstitial nephritis, with multiple

abscess formation Smears showed diplococci, no tubercle bacilli Cultures gave a colon bacillus-like growth

Since the operation, the patient's symptoms had improved, and the nocturnal frequency had diminished The case was not regarded by the pathologist as one of infarct of the kidney, but as an acute interstitial process, with marked leucocytic infiltration, which was beginning to break down into small abscesses

DR GEORGE E BREWER said the gross pathological appearance of the lesions in the specimen shown by Dr Woolsey seemed to be of the same type as those described under the name of hemorrhagic infarcts The speaker thought it was undoubtedly a blood infection We could get a good many different microscopic appearances in these cases, which was explained by Albaran on the ground that in a kidney excreting bacteria from the blood, many different pathological conditions might occur Primarily, however, they originated from a blood infection, and were due to the fact that the bacteria were carried into the arteries

DR BLAKE said he had seen quite a number of cases in which the appearance of the kidneys was typical of the specimen shown by Dr Woolsey, and, like Dr Brewer, he had always looked upon them as the result of an infection carried by the arteries They also closely resembled the lesions found in early tuberculosis of the kidney Here we had to deal with small multiple foci which later on might perhaps coalesce and form a condition resembling infarct

EXCISION OF CARCINOMA OF THE RECTUM BY THE COMBINED METHOD

DR JOSEPH A BLAKE read a paper with the above title for which see page 80

DR WOOLSEY said the combined method possessed one advantage which was perhaps not always sufficiently emphasized, namely, that it allowed the operator to learn the extent of the pelvic involvement in a way that could not be secured by the parasacral method The speaker said that when he employed the latter method he was in favor of doing a preliminary colostomy and in this way discovering the extent of the disease in the pelvis With the combined method we could go right ahead and remove much more extensive growths, or determine whether they were operable or not

DR BLAKE, in closing, said that in none of his cases had he made an attempt to construct a competent abdominal anus other than bringing the end of the bowel through an ordinary McBurney intermuscular incision. He rather hesitated to employ the procedure of separating the muscle planes and drawing the end of the gut through between them, because he felt that unless great care was taken regarding the blood supply, there was some danger of necrosis. He had found the pneumatic ring a rather good arrangement. In operating, he always took some pains to leave a long segment of the gut, so that there was a loop hanging down into the pelvis, which acted as a sort of reservoir for the feces, and prevented a constant discharge. Such an arrangement gave the fluid portion of the feces time to be absorbed.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, March 2, 1908

The President, DR WILLIAM J TAYLOR, in the Chair

CARIES SICCA

DR MORRIS B. MILLER presented a woman, aged 22 years, whose personal history was without interest until five years ago when she suffered from a prolonged and severe attack of typhoid fever complicated with pneumonia. Approximately two months after she got perfectly well her arm became weak at the shoulder and remained that way until something over a year ago when within a few weeks she lost entirely the power to raise it at the shoulder and it commenced to pain. The muscles became shrunken and the fixation grew pronounced over a period of three or four months. From the first she has had severe pains resembling neuralgia but not responding to any form of treatment. These are mainly of the area immediately surrounding the joint, but some pain is referred down the arm. Any effort to move the firmly ankylosed shoulder-joint causes considerable suffering. The clinical phenomena are clearly those of caries sicca. There is no pulmonary lesion perceptible.

Dr. Miller said he believed this condition must occur more frequently than one would gather from the literature, and he thinks it may possibly be that this condition is frequently diagnosed as arthritis. He would like to have raised the question whether, in the light of the disability his patient presented, and particularly the neuralgic pain of which she complained, an excision would be warranted and whether it would result in an improved condition.

RESECTION OF SPINAL ACCESSORY NERVE FOR
TORTICOLLIS

DR ROBERT G LE CONTE exhibited a boy of eleven upon whom he had operated six months previously for congenital torticollis. The patient's head, from birth, had been drawn to the right side, with the chin towards the right shoulder, and it was impossible for him to bring his face to the front. The right sternocleidomastoid muscle appeared to be twice as thick and strong as the left. With an anterior incision at the upper portion of the sternocleidomastoid the spinal accessory nerve was exposed before it entered the sternomastoid muscle. It was resected for a distance of half an inch.

The patient made an uneventful recovery, and now has perfect control and freedom of the motions of the head in all directions.

RUPTURE OF THE SPLEEN

DR GEORGE G ROSS read a paper on Rupture of the Spleen, with Report of Cases, for which see page 66.

DR JOHN H GIBBON referred to a case of rupture of the spleen which he had reported before the Academy some years previous. He believed that localized tenderness and rigidity were the most valuable symptoms we have for locating the injured viscus. In nearly all of the cases of rupture of the spleen which have been reported there has been marked localized tenderness and rigidity. Dr Gibbon believed that if the spleen were not so easily removed fewer splenectomies for rupture would be reported, since in the majority of these cases hemorrhage can be controlled by judicious packing. In order to control bleeding from large wounds of the spleen it may be necessary to crowd the spleen firmly up against the diaphragm. Dr Gibbon believed that any case that lived for four or five days after the rupture had occurred could be saved without splenectomy.

END-TO-END ANASTOMOSIS OF THE BRACHIAL ARTERY

DR FRANCIS T STEWART reported the following cases.

CASE I —A L, aged 42 years, was admitted to the Pennsylvania Hospital June 14, 1905, in the service of Dr Le Conte, to whom the author is indebted for the privilege of operating upon and reporting this case. The patient had been struck on the inner

side of the arm just above the elbow with a piece of flying steel. The profuse bleeding which followed was readily controlled by pressure. Subsequently the arm became greatly swollen, the skin tense, and a number of large blisters appeared over the forearm. The radial pulse was absent. The X-ray showed the piece of steel, $\frac{3}{8} \times \frac{1}{8}$ inch in size, just beneath the skin. Two days after the injury a 5 inch incision was made along the inner side of the biceps, and the brachial artery exposed at the upper angle of the wound and compressed between the fingers of an assistant. The vessel was then traced downwards until the wound in its walls was found. The piece of steel was removed with the mass of clots which surrounded the artery. The wound in the artery was transverse and involved half of its circumference. One of the brachial veins had been severed, but was closed by agglutination of its walls the result of compression. After ligating the vein the arterial wound was sutured with through and through sutures of fine silk, which controlled the bleeding but also dangerously narrowed the lumen of the artery. The injured segment of the artery was therefore resected and an end-to-end anastomosis performed by the Murphy method. This necessitated flexion of the elbow, in which position the arm was dressed on an internal angular splint. The radial pulse had disappeared by the time the dressing was completed, but reappeared the following day, although very feeble. The wound was not drained, and primary union occurred. Two months after operation the forearm could be almost completely extended, the radial pulse was as strong as on the sound side, and there was some neuralgic pain along the course of the median nerve.

CASE 2—J M, aged 32 years, was admitted to the Germantown Hospital, May 22, 1906, with a bullet wound on the inner side of the right arm just below the axilla. The following day the arm was greatly swollen and the radial pulse absent. The artery was exposed and compressed as in the preceding case, and a lacerated wound involving three-fourths of the circumference of the vessel found. As approximation of this wound obliterated the lumen of the vessel, the injured portion was resected, and the ends united with silk sutures passing through all the coats. After turning on the circulation a few additional sutures were applied to control the oozing. The wound was closed without drainage and healed by first intention. A feeble radial pulse

could be felt immediately after the operation and this increased in strength from day to day. The bullet could not be found at the operation nor could it be shown by an X-ray plate.

Dr Stewart said further that in addition to the above cases 8 others had been reported in which circular arteriorrhaphy had been performed for accidental wounds (1897, Murphy, Djemil Pacha, two cases, 1899, Kummel, Krause, 1902, Fergusson, 1904, Delanglade, 1906, Brougham), not including cases of aneurysm. Of these 10 cases the axillary artery was involved in 3, the brachial in 2, the radial and ulnar (same patient) in 1, the femoral in 3, and the popliteal in 1. In 3 the wound was caused by a bullet, in 1 by a piece of steel, in 1 by a stab wound, and in 5 the vessel was accidentally opened during a surgical operation. The largest amount of vessel resected was 2 inches (femoral). In 7 cases the vessel was united with silk, in 3 the suture material was not mentioned. The Murphy method was employed in 8 cases and simple approximation in 2. In 5 cases the peripheral pulse could be felt at the close of the operation and in 5 it was absent immediately after the operation. Infection occurred in at least 3 cases and gangrene in 2 (femoral and popliteal). In no case was secondary hemorrhage or aneurysm reported.

At the present day ligation is contraindicated for a clean wound of a large artery. Unfortunately in the very cases in which arteriorrhaphy for wounds is most strongly indicated, *i e*, in those with chronic arteritis, in whom the danger of gangrene after ligation is much increased, the sutures are apt to tear out during the operation or thrombosis is likely to occur subsequently. Even in these cases, however, he believed arteriorrhaphy should be tried, since when one considers the probability of section of the vessel by a ligature, the dangers of suture are at least no greater than ligation, and in the event of thrombosis the patient is no worse off than after the application of a ligature, indeed if the thrombus forms slowly the collateral vessels may sufficiently dilate to prevent gangrene in the affected part.

Dr JOHN H GIBBON thought that in Dr Stewart's first case a prompt clot had formed at the site of anastomosis. This is indicated by the disappearance of the radial pulse before the patient left the operating table, and its gradual reappearance would indicate the establishment of collateral circulation. In this case the invagination method was employed which is now recog-

nized as being faulty, because there is not a close contact between the intima of the two portions of the divided vessel. In Dr Stewart's second case he did an end-to-end anastomosis with a close approximation of intima, and there was evidently no obstruction after the operation. Dr Gibbon believes with Dr Stewart that arteriorrhaphy is to be preferred to ligation wherever possible.

DR STEWART thought Dr Gibbon's criticism was correct, and that thrombosis must have occurred in the first case. In his report he simply classed the cases according to whether the pulse was or was not present immediately after operation. Although his report shows that 8 of the 10 cases were done by the Murphy method, Dr Stewart thinks there can be no doubt that the simple approximation, or the Carrel circular arteriorrhaphy is to be chosen by all means. He was at first going to say that he did his second case by the Carrel method, but was afraid Carrel might object as the edges were slightly inverted instead of everted, and he did not use the guide sutures of that surgeon.

Dr Stewart thinks that the Murphy method is little used at the present day, although it was the pioneer one and paved the way for the progress which has been made along this line.

GUNSHOT INJURY OF THE LEFT HYPOGLOSSAL NERVE

DR JOHN B. ROBERTS reported this case, as follows:

A man was admitted to the Polyclinic Hospital on the 28th of March, 1907, with a gunshot wound of the left cheek over the ramus of the lower jaw. The point of entrance was about three-quarters of an inch below and about three-quarters of an inch in front of the lower edge of the lobe of the ear. The tongue when protruded pointed very much to the left (Fig 1), showing that the hypoglossal nerve was paralyzed. The left side of the man's face was covered with sweat, and the left pupil slightly dilated suggesting irritation of the sympathetic nerve.

Dr William G. Spiller examined the patient two days after his admission and supplied the following notes:

The left facial nerve is very paretic but not completely paralyzed. The upper branch of the nerve has probably escaped injury. The man can nearly close the lids of the left eye. The left side of the tongue is completely paralyzed. The organ while in the mouth deviates to the right, but is greatly deviated to the left when protruded. He is unable to move the tongue to the

left, except a very little beyond the median line, unless it is protruded. This shows injury to the hypoglossal nerve. The soft palate is moved well on both sides when he says "Ah!" and is not paralyzed. He swallows fluids without difficulty when he is sitting up. The pneumogastric and glossopharyngeal nerves have probably escaped injury. The sympathetic has been injured.

He sweats profusely on the left side of the face. The sweating also extends down to the upper part of the shoulder and upper part of the left arm. The right side of the face is dry. The jaw is not deviated when his mouth is open (Fig. 2). The masseter muscles contract well on both sides. Sensations of touch and pain are normal on both sides of the face. Salt and sugar are both well tasted on the left side of the tongue. The grasp of the hands and the power of the legs are normal. There are no symptoms of involvement of the brain.

The left pupil is slightly dilated but seems to react to light.

On April 3d, after locating the bullet by means of two X-ray pictures, Dr. Roberts operated for extraction of the missile. The wound in the cheek was suppurating, though it had been packed with iodoform gauze. The probe showed that the bullet had gone through the ramus of the mandible a short distance below the sigmoid notch. An incision was made around the angle of the jaw and the parotid gland pushed forward. By burrowing with a finger he was able to get behind the pharynx and explore the region in front of the first and second cervical vertebræ. He could feel distinctly the transverse portion of the first vertebra and with some manipulation was able to discover what seemed to be a foreign body, which was slightly movable, to the inner side of the mastoid process in front of the second cervical vertebra. A porcelain tipped probe being introduced proved this to be lead. With forceps such as are used for cleft palate operations he was able to extract the ball. He then found that it had lain in a depression in front of the spinal column and that there were some small fragments of bone there. It is possible that these were pieces carried in from the perforation of the mandible. The space in which the ball lay was either the normal space between the first and second transverse processes or was a depression made by the bullet in the body of the second vertebra. The depth of the wound made it impossible to definitely determine whether the hypoglossal nerve at this point was actually divided, though it

FIG. 1.



Gunshot section of left hypoglossal nerve

FIG 2



Gunshot injury of left hypoglossal nerve

probably was cut close to the base of the skull. No attempt was made to suture it because of the danger of operating in such a region. The patient's favorable condition and the known rather unimportant results of hypoglossal injury were not such as to warrant interference.

When the man was admitted there was a good deal of difficulty in swallowing from want of control of the saliva, but at the time the operation was done he had gained fair control of these functions and the removal of the bullet seemed to be all that was indicated. The wound was treated by inserting a drainage-tube and packing.

The patient did well for a number of days. He had practically a normal temperature after a slight rise immediately subsequent to operation. On April 6th his temperature went up a little. On the 8th some moist râles in the upper part of the left lung could be heard. He complained of cough which had bothered him for about a day. The drainage-tube was withdrawn and the wound dilated, which evacuated a little fluid, and orders were given to wash the wound out with sterile salt solution twice a day. The drainage-tube was not returned, but the packing was continued. The next day his respiration was practically normal and the lung condition seemed to be better. His cough had been controlled apparently by occasional doses of five grains of ammonium carbonate and a sixteenth of a grain of codeine sulphate. The patient had been allowed for several days to sit up in bed and was advised to lie particularly on his left side to facilitate drainage.

Later sonorous râles were heard in the posterior part of the right chest. There was some tenderness on percussion of the left chest near the posterior edge of the left scapula, and a loss of resonance at the upper part of the right chest posteriorly. The gums were spongy, though no mercury had been taken to cause it. It was thought that possibly the bloody tinge of the expectoration might have come from this gingival condition. Bacteriological examination of the sputum showed the presence of pneumococcus, staphylococcus pyogenes aureus and bacillus proteus vulgaris. Urinary examination showed nothing abnormal. The temperature for a few days previous to this time and also at this time varied from 100° to 102° , the respirations from 24 to 28, the pulse from 90 to 100.

An examination of the chest made later by Dr David Riesman showed that there was impaired resonance on the right side at the fourth and fifth interspaces over a limited area reaching to the axilla. Here crackling râles were heard with feeble breath-sounds and diminished fremitus. There was some pain in this region. The patient had had no chill and no night sweats, but was rapidly losing flesh. No tubercle bacilli were found in the sputum. His red blood cells were 2,150,000, white blood cells 26,200, hæmoglobin 85 per cent. The man was emaciated and weak, had a troublesome cough, and his throat seemed a good deal filled up with mucus. There was very little discharge from the original wound or the incision made for the extraction of the bullet. At the end of the month further operation was suggested to explore the wound and to facilitate drainage, but the man declined to submit. By the 7th of May he was very much better and walking around the ward. On the 12th of May he left the hospital without permission, considering himself well enough to go.

In July Dr Roberts heard that the patient had been admitted to the tuberculosis wards of the Philadelphia General Hospital under the care of Dr Ward Brinton. Dr Brinton stated that tubercle bacilli had been found in the feces, but not in the sputum. There was, however, extensive pulmonary involvement. A few days later the patient died. The wounds in the neck and face had become healed. The Resident Physician, Dr William Shields, had informed him the case was first thought to be one of gangrene of the lungs on account of the odor of the sputum. Tubercle bacilli were not found in the sputum nor was the streptothrix. At the autopsy six slides were taken from a cavity in the right lung and stained for tubercle bacilli but none were found.

The pathological diagnosis made was tuberculous bronchopneumonia. The pathologist was of the opinion that the gunshot wound of the neck involving the hypoglossal nerve had nothing to do with the lung condition.

The further notes of the autopsy, furnished by Dr Shields, are as follows:

Right pleura firmly adherent from apex to base in midaxillary line. Slight adhesions of the left pleura in the region of the first and second ribs. The pericardium contained 60 c c of straw-colored fluid, and extended 7 cm to right of midsternum.

FIG 3



Case of gunshot wound of the left hypoglossal nerve

In the right pleural sac there were 300 c c of straw-colored fluid. Heart smaller than normal, but otherwise negative. Left lung slightly emphysematous and contained some cedematous fluid. Right lung was covered with thick pleura, both layers of which were firmly attached. Both lobes were firmly attached and showed tuberculous bronchopneumonia. The lower lobe contained three good-sized cavities in which was cheesy material. The two lower cavities communicate with a bronchus. The other organs show nothing of importance. The diagnosis was tuberculous bronchopneumonia with chronic adhesive pleurisy.

Little doubt exists that in this case the hypoglossal nerve was divided. The dilated pupil and the unilateral sweating lead to the supposition that the sympathetic nerve was the seat of irritation. It is perhaps possible that the lids of the left eye suggested paresis of the facial nerve, when the real cause of their apparent loss of power was a slight protrusion of the eyeball due to sympathetic irritation. Division of the sympathetic would be expected to cause contraction of the pupil and sinking of the eyeball.

The location of the bullet in front of the second cervical vertebra near its transverse process on the left side corresponds with the upper part of the superior cervical ganglion of the sympathetic nerve. It is opposite this vertebra too that the hypoglossal nerve receives communicating branches from this sympathetic ganglion.

A missile dividing or destroying the hypoglossal nerve by pressure would be very likely to cause coincident irritation of the sympathetic ganglion in the same region. Had the patient lived, part of the spinal accessory nerve or the lingual branch of the trifacial nerve might have been transplanted into the distal part of the hypoglossal in order to restore motion to the left side of the tongue.

DR JOHN H. JOPSON referred to a case of injury of the median nerve of a peculiar type which he had recently encountered. The man had been struck on the inner side of the arm by a piece of steel scale while driving a bolt through a piece of sheet steel. An X-ray photograph showed a very small piece of steel located in the neighborhood of the brachial artery. The patient complained at this time of tingling or electrical sensations in the ring and little finger, on the palmar surface, or in other

words, in the distribution of the ulnar nerve Dr Jopson saw him several days later and had a second X-ray plate made, and localized this very small foreign body in its relation to the wound of entrance, which was the only localizing point that could be utilized, being situated at about the middle of the arm By this time the sensory disturbances had disappeared to some extent, although the patient complained of them at times when he attempted to use the arm, and still in the distribution of the ulnar nerve There was slight tenderness over the site of the wound On exposing the region where the foreign body had been localized a large nerve presented itself, and on examining it closely it seemed at one point to be a little swollen and injected By probing with a pair of fine forceps Dr Jopson found an opening in the nerve, and was able to remove the foreign body, which was deeply embedded and completely concealed in what proved to be the median nerve and not the ulnar It was a thin scale, measuring 4 mm in diameter After the operation the patient had the same tingling sensations for 24 hours, but now in the distribution of the median nerve, that is, in the thumb, index and middle fingers, and not in the distribution of the ulnar nerve as formerly

The reference of the pain to the distribution of the ulnar nerve, rather than to that of the median, was difficult to explain The foreign body could not possibly have injured it, as the wound of entrance lay between the nerves

DR GEORGE M. DORRANCE said that he saw the case reported at the Polyclinic Hospital, and that he followed the patient from there to the Philadelphia Hospital, but lost track of him when his body was sent to the University The report from the man who macerated the body was that the first cervical vertebra and part of the occipital bone was injured, and from his description of it one would imagine that the nerve was injured just as it came out from the anterior condyloid foramen Therefore an operation would not have been of value, as it would have been impossible to reach the upper end of the nerve

ANNALS OF SURGERY

VOL XLVIII

AUGUST, 1908

No 2

ORIGINAL MEMOIRS.

TETANY FOLLOWING THYROIDECTOMY CURED BY THE SUBCUTANEOUS INJECTION OF PARATHYROID EMULSION.

BY JOSEPH H BRANHAM, M D,
OF BALTIMORE, MD

M L L, white, female, American, age fourteen years and four months, was sent to the Franklin Square Hospital, Baltimore, February 21, 1907, by Dr A E F Grempler, with diagnosis of goitre. The enlargement of the thyroid was noticed in June, 1906, but the growth did not increase very rapidly. For several weeks previous to the operation the patient had been frequently awakened at night by throbbing pain in her neck accompanied by a sensation of choking.

The operation (4 30 P M, February 21, 1907) was not especially difficult. The tumor on the right side was about the size of an orange and was deeply seated and twisted from its normal plane. This was removed first and while I tried to leave the posterior capsule and to avoid the parathyroids, I felt uncertain of having succeeded, and remarked to my assistant that on the left side where the growth was smaller and its position normal I would be careful not to interfere with these bodies. In this it will be noticed from the pathological report, I was only partially successful, as part of one was removed on this side. The patient lost but little blood and was taken from the operating room at 5 10 P M. Her pulse, 90 before and 104 after the operation was strong and regular, and her temperature 37° C. She was making an apparently uninterrupted recovery until 8 00 A M, February

25—eighty-eight hours after the operation, at which time her teeth became clinched. Shortly afterwards her hands became contracted and her feet affected (*Talipes equinovarus*), wrists flexed on forearms (full flexion) and forearms slightly flexed on arms (at right angles). Reflexes were not exaggerated, no elbow or wrist jerk. The patient's head was thrown back, teeth clinched but her face not distorted, her head, shoulders, buttocks and heels only touching the bed. There was a marked rise of temperature, 38.5°C . The patient says the first indication of the trouble was a stiff feeling around the mouth, and later a drawing up of her thumbs. Her hands became "drawn up" and her feet cramped, also a tingling pain seemed to radiate from her head and shoot over her body and limbs, but at no time was the pain severe. She had great difficulty in swallowing, due solely to inability to move her tongue freely, it being (as she expressed it) "stiff". The symptoms toward the last of the attack were alarming. The tetany was marked by distinct exacerbations much like tetanus. During these the pulse was rapid and weak and the respiration was greatly interfered with. At times she would not breathe for a considerable period and would appear to be in such imminent danger that artificial respiration was necessary.

Blood—Hæmoglobin 85, red cells 2,500,000, leucocytes 12,000, polymorphonuclears 70 per cent, large 4 per cent, small 24 per cent, eosinophiles 0.40 per cent, transitional 1 per cent, leucocytes counted 1000. This count was made when the contractions were most pronounced. Leucocytosis in this case must have been due in some way to the effect of the operation on the thyroid or parathyroids, as there was no infection.

The patient was ordered 0.192 Gm of thyroid extract every three hours, beginning Sunday, February 25, at eleven o'clock A.M. Also every four hours she was given 0.0648 Gm of parathyroid extract, but obtained no relief, in fact, the contractions were becoming more marked all the time. On Monday twenty-eight fresh beef parathyroids were secured. Six of these raw were forced into the patient's mouth and she succeeded in swallowing them. This was repeated on Tuesday morning and again on Tuesday night. The symptoms becoming more pronounced, on Tuesday night five of the glands were placed in 1:1000 solution of bichloride of mercury and allowed to soak about ten minutes. Observing strict asepsis the glands were cut into fine

pieces under physiological salt solution. These pieces were placed into a mortar and ground into a homogeneous mass, 400 c c of sterile salt solution being poured into the mortar. This was then filtered through sterile gauze and given as salt transfusion into the patient's breast at 10 00 P M. At 1.30 A M. on the following morning she was asleep and the contractions were becoming gradually less violent. They disappeared in her hands, arms and face by 10 00 A M., and her lower extremities were nearly relaxed. Her temperature dropped from 38.5°C at 8 00 P M. on the 27th to 36.8°C on the 28th. All contractions had disappeared by noon on the 28th, and it was impossible to cause them by pressure on the artery supplying the part. Tapping on the transverse branch of the facial nerve still caused fibrillar contraction, but this disappeared by the morning of March 1. Parathyroids were discontinued by mouth on the morning of the 28th and parathyroid and thyroid extracts were discontinued on the morning of March 1. There were no contractions between February 28 and March 2. At 3 45 P M., Saturday, March 3, the patient developed a recurrent attack which lasted twenty minutes and involved only the face. This was succeeded by milder attacks which lasted until about 11 30 P M., at which time she was given two parathyroids subcutaneously in 100 c c of salt solution. The attacks ceased almost immediately, and the patient has remained free from any symptoms of tetany up to the present time—more than a year after operation.

When this patient's condition became desperate and the use of the thyroid and parathyroid extracts and the feeding of the raw parathyroids proved entirely useless, I called up Dr W G MacCallum of the Johns Hopkins Hospital whom I knew had been doing much experimental work on tetany, hoping to find some method of using the parathyroids by injection. He told me he had used an emulsion of the fresh glands in dogs many times with no ill effects and with good results, and urged that we try it on our patient. The emulsion was prepared and used at the hospital after his directions.

The pathological examination showed colloid degeneration of the thyroid, right gland much the larger, and on its posterior aspect were found one whole parathyroid and parts of two others. On the left gland which was smaller, part of one parathyroid was

pressure, a few drops of cloudy sticky fluid. The sinus was injected with bismuth in water and an X-ray plate taken. This plate (Fig 1) showed a shadow extending upward, corresponding to the indurated area in shape and direction. Unfortunately the base of the skull is not on the plate.

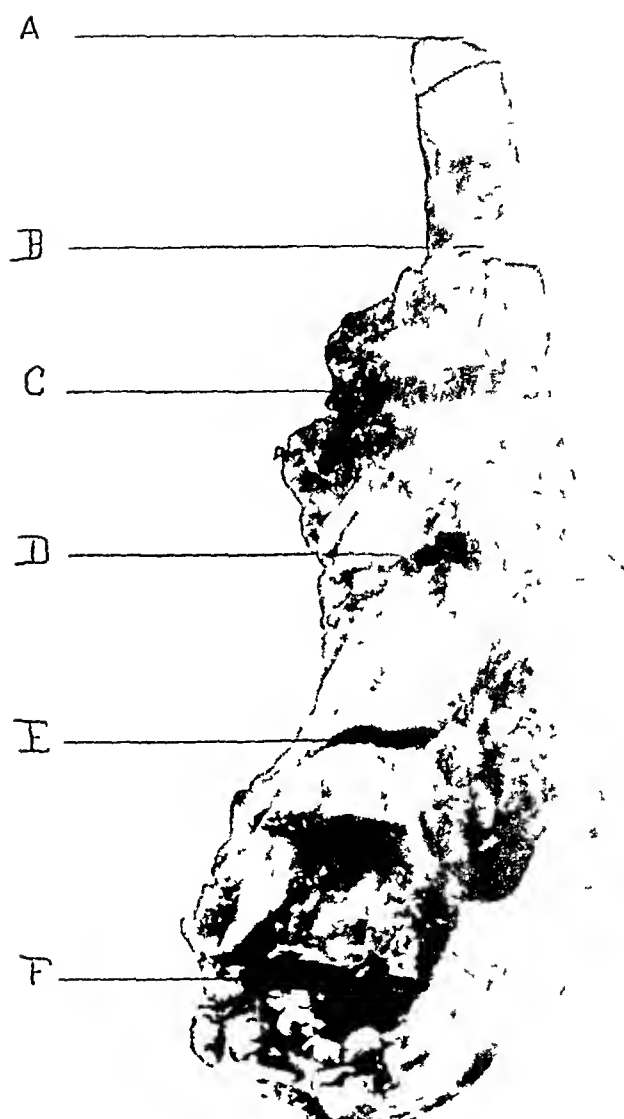
Operation—Incision, the entire length of posterior margin of sternomastoid. The mass was found to have a well marked capsule which enabled easy separation from the sternomastoid, with which it was in intimate contact. At the level of the angle of the jaw the mass narrowed to a rounded strand about $\frac{1}{2}$ inch in diameter. This passed upward and forward underneath the sternomastoid, and became smaller and firmer and about $1\frac{1}{2}$ inch below the base of the skull it terminated in a cartilaginous column about $\frac{1}{4}$ inch in diameter. Throughout the entire length the mass could be shelled with comparative ease from the surrounding structures. The upper end was so firmly attached to the external auditory canal at the junction of the bony and cartilaginous portion, that in the process of removing the external canal was opened.

The relation to the surrounding structures of the neck was as follows. In the posterior triangle of the neck the mass lay beneath the deep cervical fascia with the exception of the sinus at the bottom. Anteriorly it was in contact with the posterior margin of the sternomastoid. Posteriorly and externally it was surrounded by the fat filling the posterior triangle and separating it from the trapezius and structures forming the floor of the triangle.

At the angle of the jaw where it passed forward and upward, underneath the sternomastoid muscle, it came in touch with the jugular vein. The upper portion passed beneath the occipital artery, left the jugular vein and was behind and to the outer side of the stylo-hyoid and stylo-pharyngeus. The last $\frac{1}{2}$ inch was separated from the styloid process by a space just admitting the forefinger. The facial nerve did not come into the wound so that I am unable to state definitely its relation, but am of the opinion that the nerve crossed behind and to the outer side.

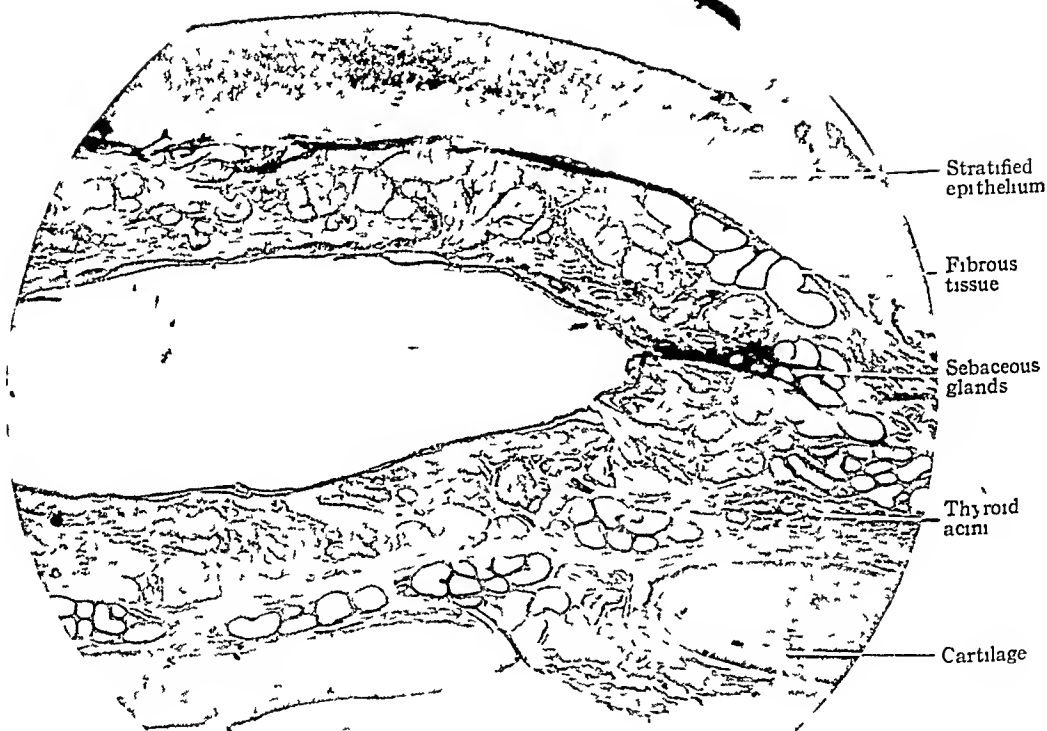
The wound healed by first intention, the patient leaving the hospital on the eighth day. The specimen was preserved in formalin and sections cut from the levels indicated in Fig 2.

FIG 1



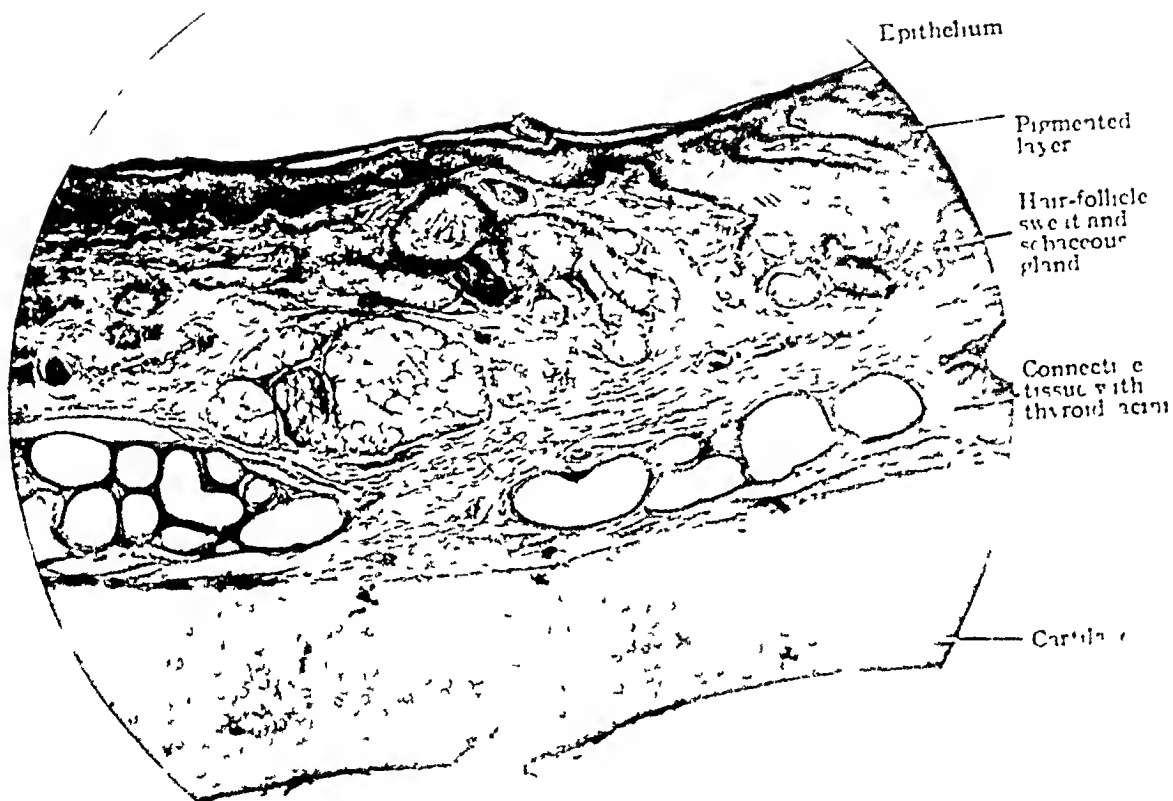
Photograph of specimen

FIG 2



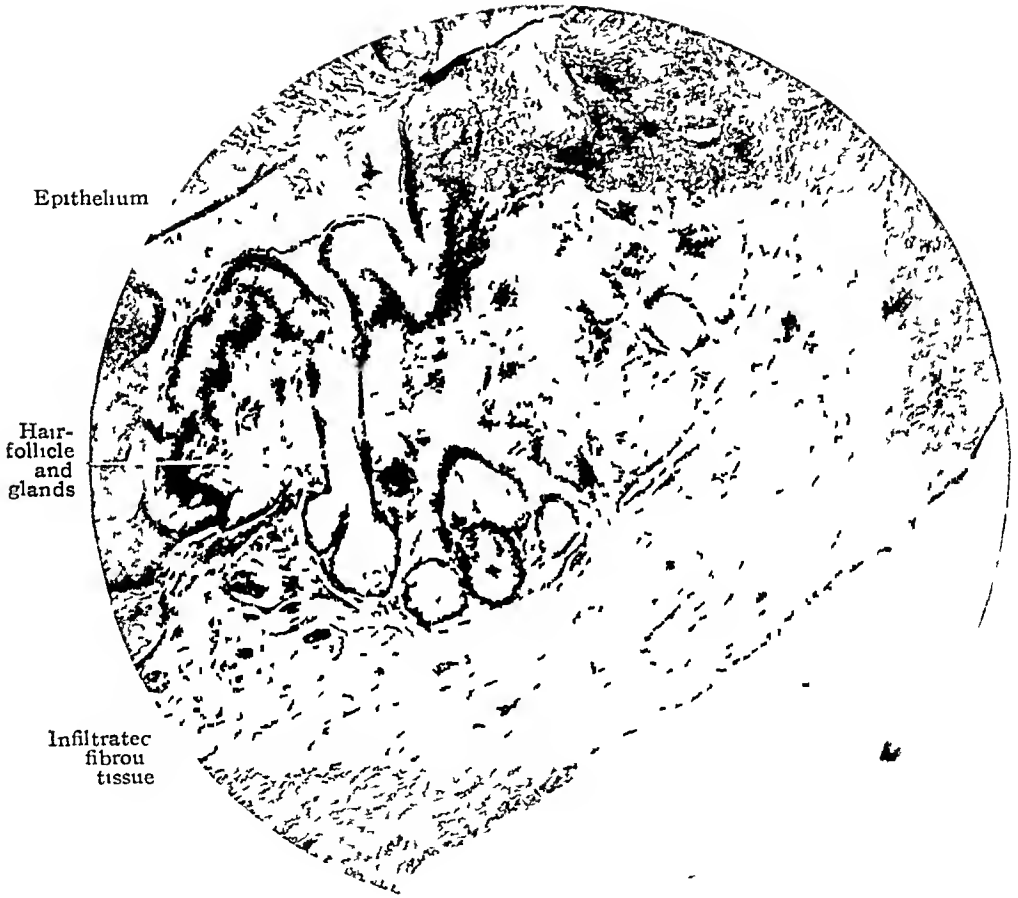
Section of entire cleft at level A (See FIG 1)

FIG 3



Enlargement of section shown in Fig 2

FIG 4



Enlargement of section taken through secondary cyst at level B (See FIG 1)

FIG 5



Taken from lower levels C D F Fig 1 present same condition

FIG 6



Radiograph showing cavity of sinus injected with bismuth subnitrate

The pathological report follows

The cyst is a pear-shaped structure having a length of 12 cm and a transverse diameter at the widest part of the cyst body of 4 cm (Fig 1) The neck is 3 cm long and has a diameter of 1 cm at its upper end and 1½ cm where it begins to widen out into the cyst body The lumen of the upper end of the neck measures ½ cm, and about the circumference of this part there is a smooth plate of cartilage on one side and irregular cartilage formation on the other Two centimeters below the opening of the cyst and leading off from the canal of the neck there is developed in the wall a secondary cyst cavity 1 cm long

SECTION A—Made transversely across the upper end of the neck, shows the following structure from within out

First—A layer of stratified squamous epithelium identical with that found on the general skin surface, having the typical horny layer and epithelial cells Two or three layers of the superficial epithelium lying immediately under the horny layer contains a large amount of black granular pigment

Second—Beneath the epithelium there is a thin margin of very dense fibrous connective tissue through which are scattered young fibrous tissue cells

Third—A zone of very large sebaceous glands which are so numerous and closely packed together as to form a distinct layer A few very wide ducts can be seen running from these glands to the surface of the lumen through the epithelium The glands are held together by very firm fibrous tissue A few hair follicles are scattered through this gland layer

Fourth—A layer composed of thyroid gland tissue The acini are very large and lined with low cuboidal epithelium which throughout contains a large amount of light yellow granular pigment A few of the acini contain colloid

Fifth—A zone of normal cartilage which is represented by a single plate on one side and by three smaller plates on the opposite side of the wall The cartilaginous plates are held together by very dense fibrous tissue

SECTION B—Made 2½ cm below section A includes a section through the secondary cyst This pouch is lined by stratified squamous epithelium, having a horny layer, beneath which are a few sebaceous glands and hair follicles Around the epithelium and glands is a layer of very dense fibrous connective tissue extensively infiltrated by inflammatory round cells and leucocytes The main canal in this section shows a lining of thick granulation tissue composed of young fibrous tissue cells, leucocytes and young blood vessels Outside of this inflammatory layer the wall is composed of dense fibrous tissue infiltrated with young fibrous tissue and migrating inflammatory cells

OTHER SECTIONS—Taken at 4 cm (C), 6 cm (D), 8 cm (E) and 12 cm (F) from the neck of the cyst show a fibrous tissue wall lined by granulation tissue containing few squamous cells

Points of Particular Interest—First, lateral sinus of neck from first cleft, second, presence of thyroid tissue, third, relation to structures of second arch, the sinus being behind and underneath the upper portion of sternomastoid muscle

TECHNIQUE OF EARLY OPERATION FOR THE REMOVAL OF TUBERCULAR CERVICAL LYMPH NODES.*

BY CHARLES N. DOWD, M.D.,

OF NEW YORK,

Attending Surgeon at the General Memorial Hospital and St. Mary's
Free Hospital for Children

IN the removal of tubercular cervical lymph nodes thoroughness is surely very important. All infected nodes should be removed, when practicable, for, although the encapsulation of a limited infection is possible, its spread to other tissues is much more probable. The effort to procure thoroughness in this operation has frequently led to an utter disregard of the scars which are produced, and patients are frequently deterred from operation through fear of the resulting disfigurement. In certain cases of advanced and general cervical tuberculosis this disregard of resulting scars is to be advocated. It is better to save life and leave scars than to sacrifice the patient.

In other instances, however, a scar-saving operation is compatible with thoroughness. The infection in about 85 per cent of the cases as they appear in New York first involves the subparotid group of lymph nodes, the nodes which form the first barrier to the spread of infection from the pharynx and tonsillar region. There is a characteristic appearance to the patients during the early part of this infection. The accompanying photograph (Fig. 1) indicates this appearance. The nodes just below and behind the angle of the jaw and under the upper part of the sterno-cleido-mastoid muscle are enlarged slightly movable, rather tense, and usually free from evidence of acute inflammation. They frequently remain in this condition for several months, sometimes increasing and again

* Read before the Surgical Section of the New York Academy of Medicine, February 7, 1908

diminishing in size, and during this period they may usually be thoroughly removed through a transverse incision, which is about two and a half inches in length, which lies in, or parallel to, the folds of the neck and which, after healing, is hardly to be seen

The arrangement of the infected nodes in these early cases is almost uniform, and the technique of their removal is as definite as that of the average surgical procedure. The writer ventures to give diagrams showing the stages in an operation which he has found very useful in many cases, hoping in this way to promote early operations for these patients. These diagrams are photographs taken during the operation on the child shown in Fig 1, or drawings from such photographs.

The skin incision is indicated in Fig 2. It is made at least a finger's breadth below the border of the jaw, and should be straight and parallel to a neck crease. After reaching the platysma, the skin should be drawn downward and the incision to or through the deep fascia may be made at a little lower level than the skin incision. The collo-mandibular ramus of the facial nerve lies between the platysma and the deep fascia, and by suitable retraction it can be carried upward with the muscle, and its injury thus avoided.

The exposure which exists after this step is shown in Fig 3. The margin of the sterno-mastoid muscle may then be retracted backward, freeing it from its attachments considerably above and below the site of the incision. The tonsillar node is then usually clearly brought into view and, by blunt dissection, may be detached from its anterior attachments, but should not be separated from the adherent nodes behind it. The mass of nodes which is grouped here is usually much larger than would be indicated by the external appearance of the neck. Their capsules may be grasped by toothed clamps and their attachments divided so as to give about the appearance indicated in Fig 4.

As the deeper portion of this mass is being separated from the surrounding tissue there is danger of dividing the spinal accessory nerve above its entrance into the sterno-

mastoid muscle The nerve is often completely surrounded by the node mass and may easily be mistaken for a portion of its capsule In searching for it the portion of the node mass which is shown in Fig 4 is often separated from the nodes which lie still higher and further back under the sterno-mastoid muscle

Fig 5 indicates its appearance after such separation, the deeply lying node on which it rests being drawn forward and the anterior border of the sterno-mastoid muscle being turned backward The nodes may then be removed from beneath the upper part of the sterno-mastoid muscle as far back as its posterior border This should leave a clean dissection of the area between the skull and line of the incision

The nodes below this incision and beside the internal jugular vein may then be grasped by clamps and drawn upward while the lower margin of the wound is drawn downward, giving the appearance indicated in Fig 6 By careful dissection and suitable retraction the node-containing area may then be explored almost down to the clavicle, and backward into the posterior chain behind the lower posterior margin of the sterno-mastoid avoiding of course the lower part of the spinal accessory nerve in this region The lower extent of the area here exposed is shown in Fig 7 If there is difficulty in the dissection of this lower area, a second transverse cut may be made just above the clavicle

Fig. 8 indicates the appearance of the wound area at the close of the dissection, but does not show the entire extent of this area, since the skin can be moved both upward and downward by retraction

The method of wound treatment is important Drainage should be provided, since there are wide spaces for the collection of serum, and possibly lymph and blood, and since there are defective lymphatics to provide for their absorption A limited drainage, however, is usually sufficient The method shown in Fig 9 has proved satisfactory, a counter-opening is made below the incision and several strands of silk or silk-worm gut are passed through this and through the wound

The wound itself is closed with subcuticular stitches, excepting at the drain opening, a small piece of moist gauze is there applied, covered by rubber tissue and kept moist by the application of a few drops of saline solution applied under the rubber tissue every few hours

In many cases this drainage, of course, is not needed, but where there are broken down nodes it is often very important, and it is a safe and easy method for all and if properly cared for is almost an absolute safeguard against deep-lying infection

The patients are usually allowed out of bed on the second or third day after the operation and can leave the hospital within ten days, or two weeks

The patient from whom these pictures were taken has remained free from recurrence, it is now two and a quarter years since his operation Fig 10 shows his appearance one year after operation The scar is hardly to be seen, and he is very sturdy and strong

The *possibility of vein injury* may be considered in a separate paragraph There is of course extensive vein exposure in this dissection and the possibility of vein injury Probably the vein most frequently injured is the posterior facial (see diagram, Fig 11) It is occasionally adherent to the upper part of one of the enlarged nodes, and in the retraction it looks like a part of the node capsule and if nicked it may give a bothersome hemorrhage in an unexpected place, and since one naturally looks to the internal jugular as the probable source of such a hemorrhage, the real source may not be discovered at once Small veins which run from the nodes into the large veins are also frequent sources of hemorrhage When flattened out on the node they are not to be distinguished from the node capsule, and since they are close to the internal jugular or common facial veins their section may easily cause troublesome hemorrhage Fig 12 shows such a vein and Fig 13 shows other inconstant veins which have been noted during operation

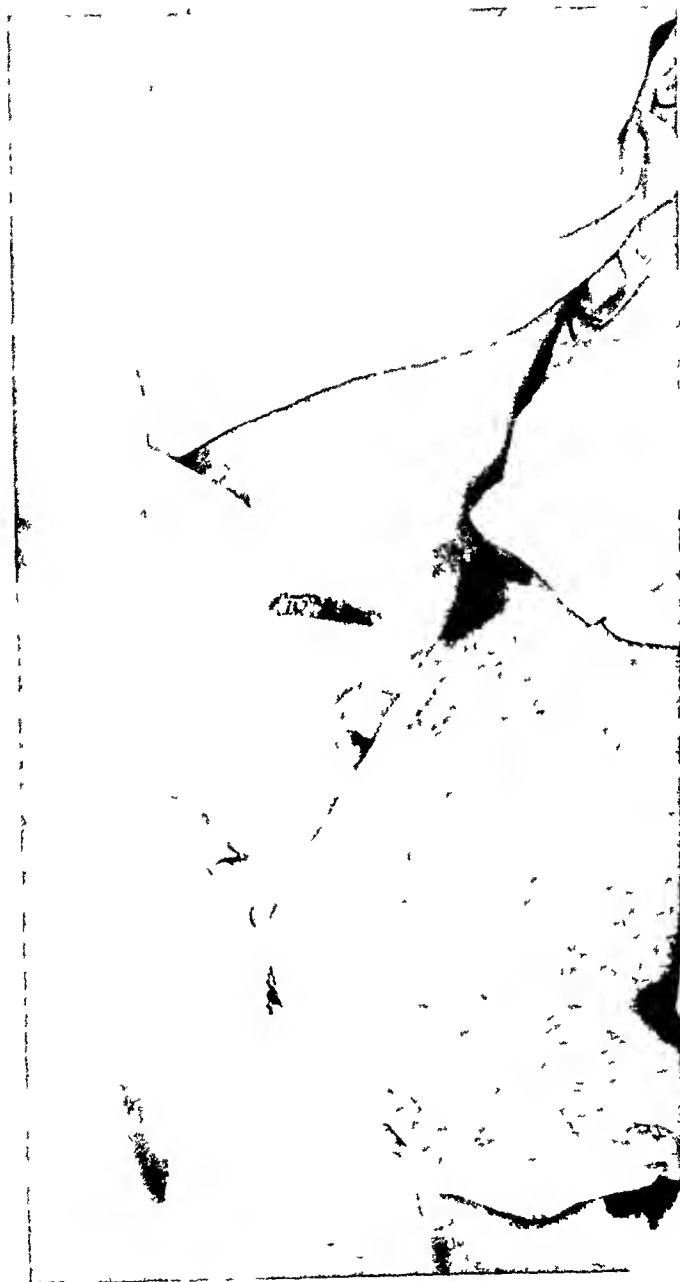
An injury of one of these veins near its distal end is

FIG 1



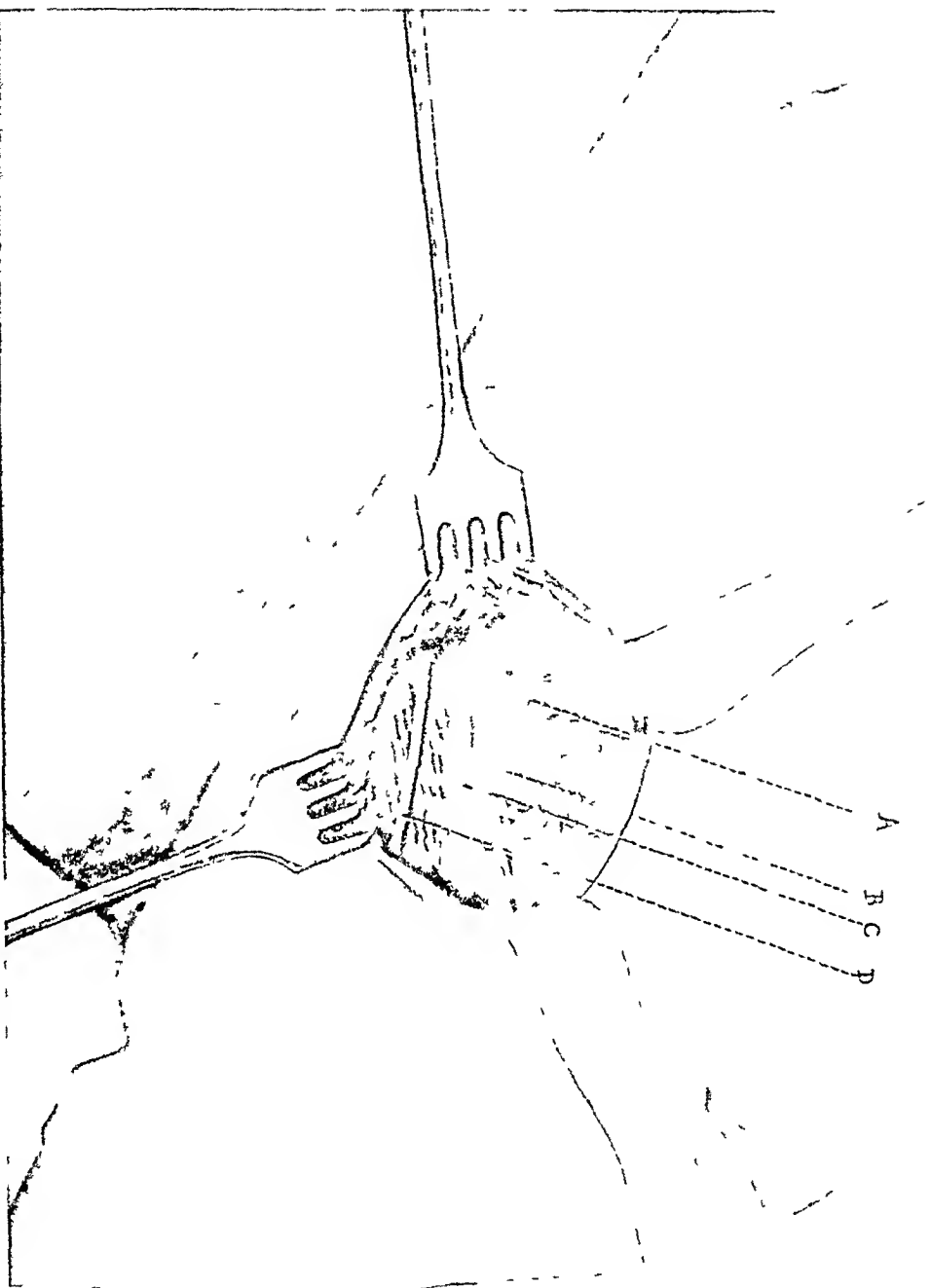
Early case of tuberculosis of the cervical lymph nodes. The swelling had first appeared about ten months previously. In the meantime the nodes had increased, then subsided and again increased in size. The subparotid nodes which are here shown are probably the first ones enlarged in about 85% of the cases as they appear in New York.

FIG 2



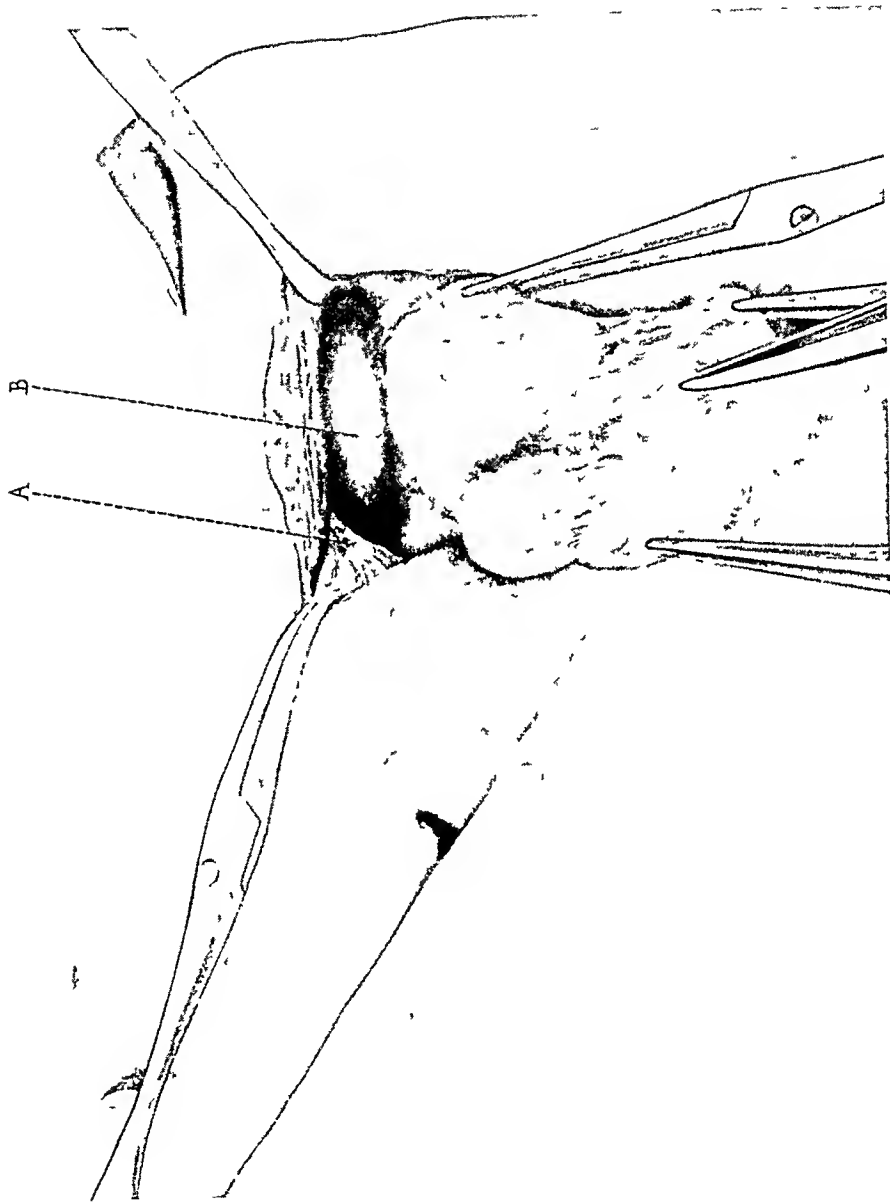
Incision made at least a finger's breadth below the border of the jaw and in, or parallel to, a neck crease

FIG. 3

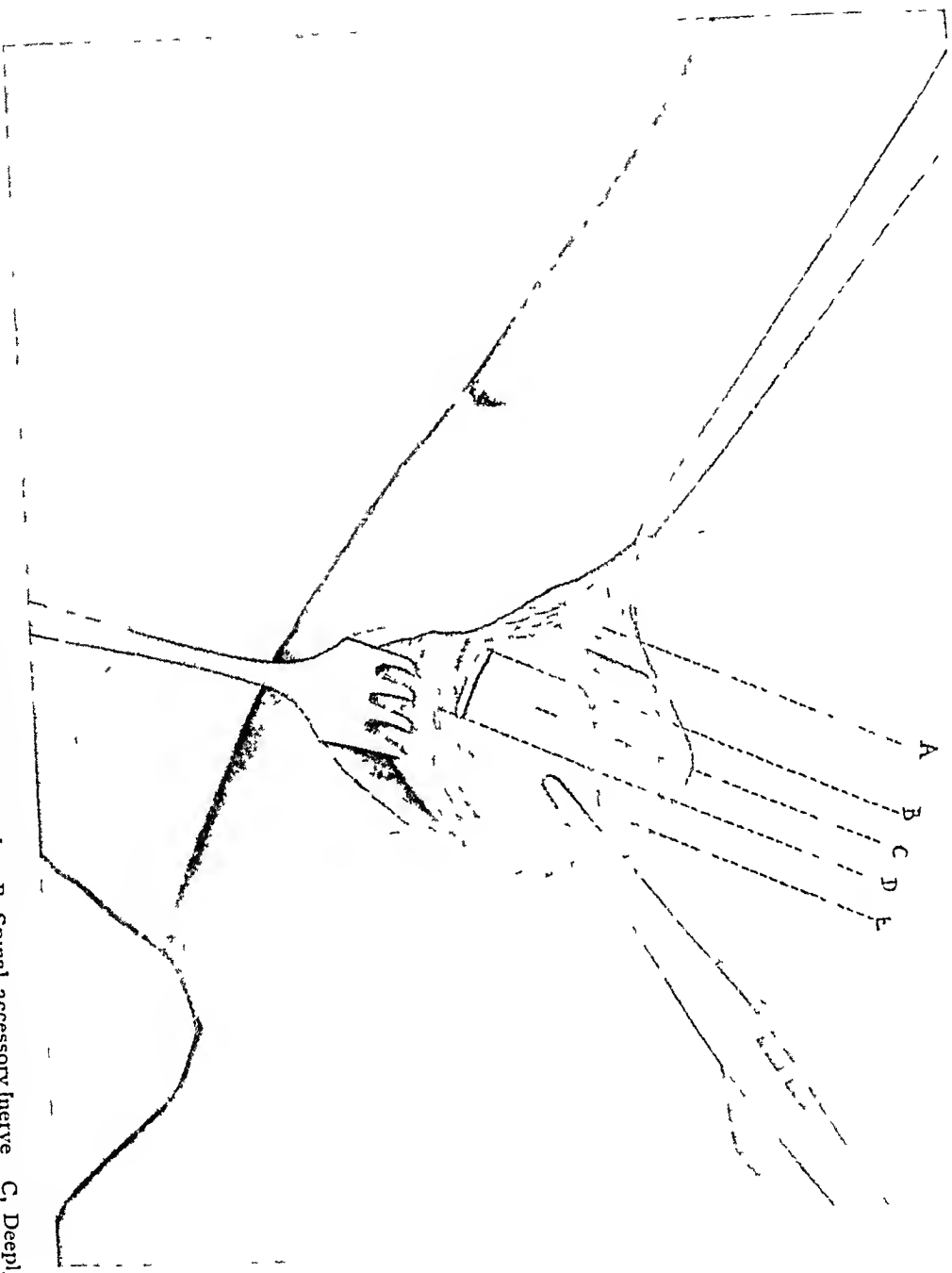


Exposure after resection of pharynx and deep fascia. A, Lymph nodes. B, Sternomastoid muscle. C, External jugular vein. D, Great auricular nerve.

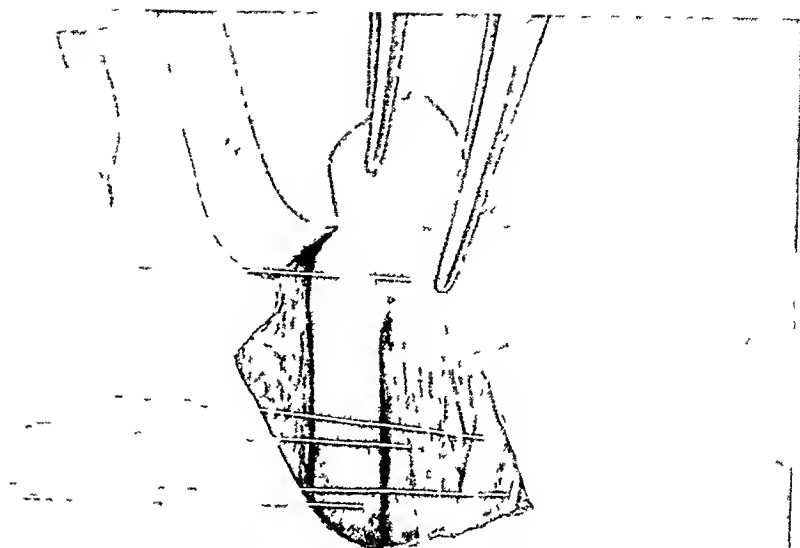
FIG 4



Main mass of lymph nodes, drawn out and reflected backward A, Posterior belly of digastric muscle B, Internal jugular vein



Exposure of spinal accessory nerve. A, Posterior belly of digastric muscle. B, Spinal accessory nerve. C, Deeply lying lymph node, drawn forward. D, Sternomastoid muscle drawn backward. E, Internal jugular vein.



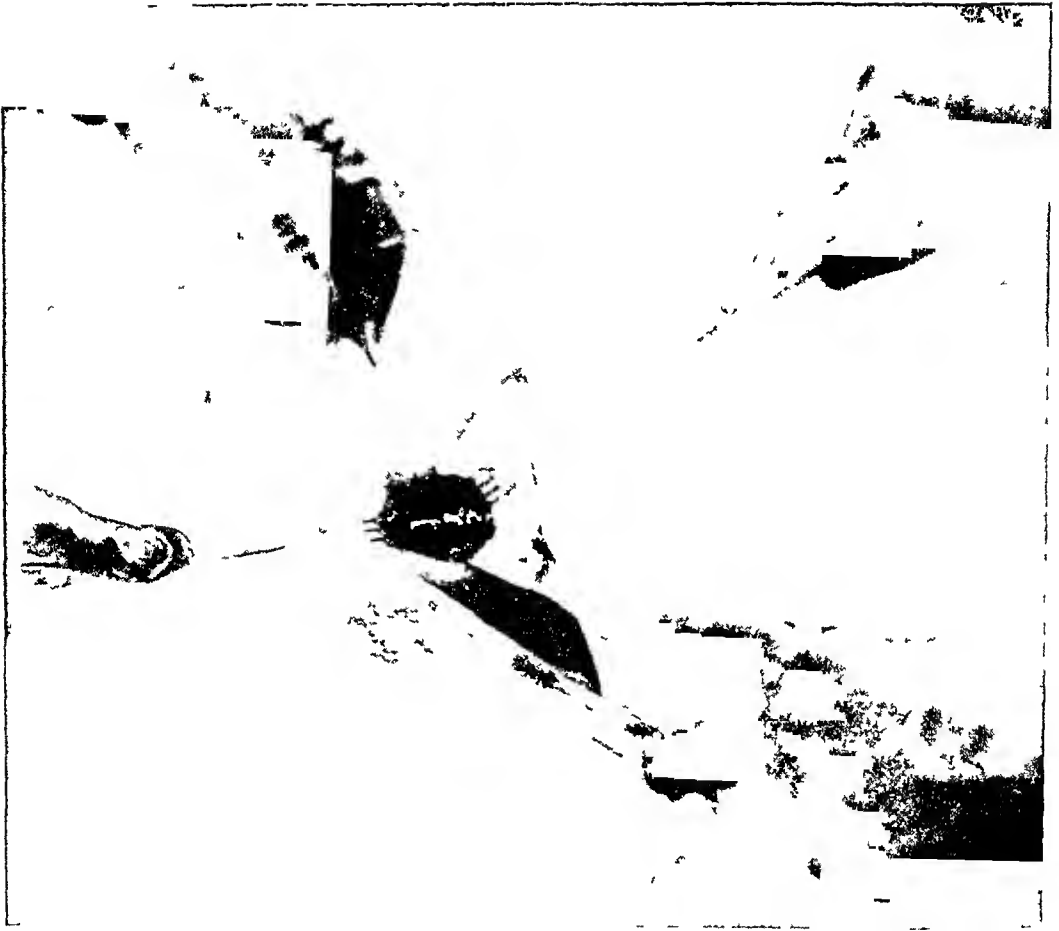
Removal of nodes from the lower part of the deep cervical chain A, Internal jugular vein B, Sternomastoid muscle C, External jugular vein D, Great cervical nerve E, Nodes from the deep cervical chain drawn forward, upward and outward

FIG 7

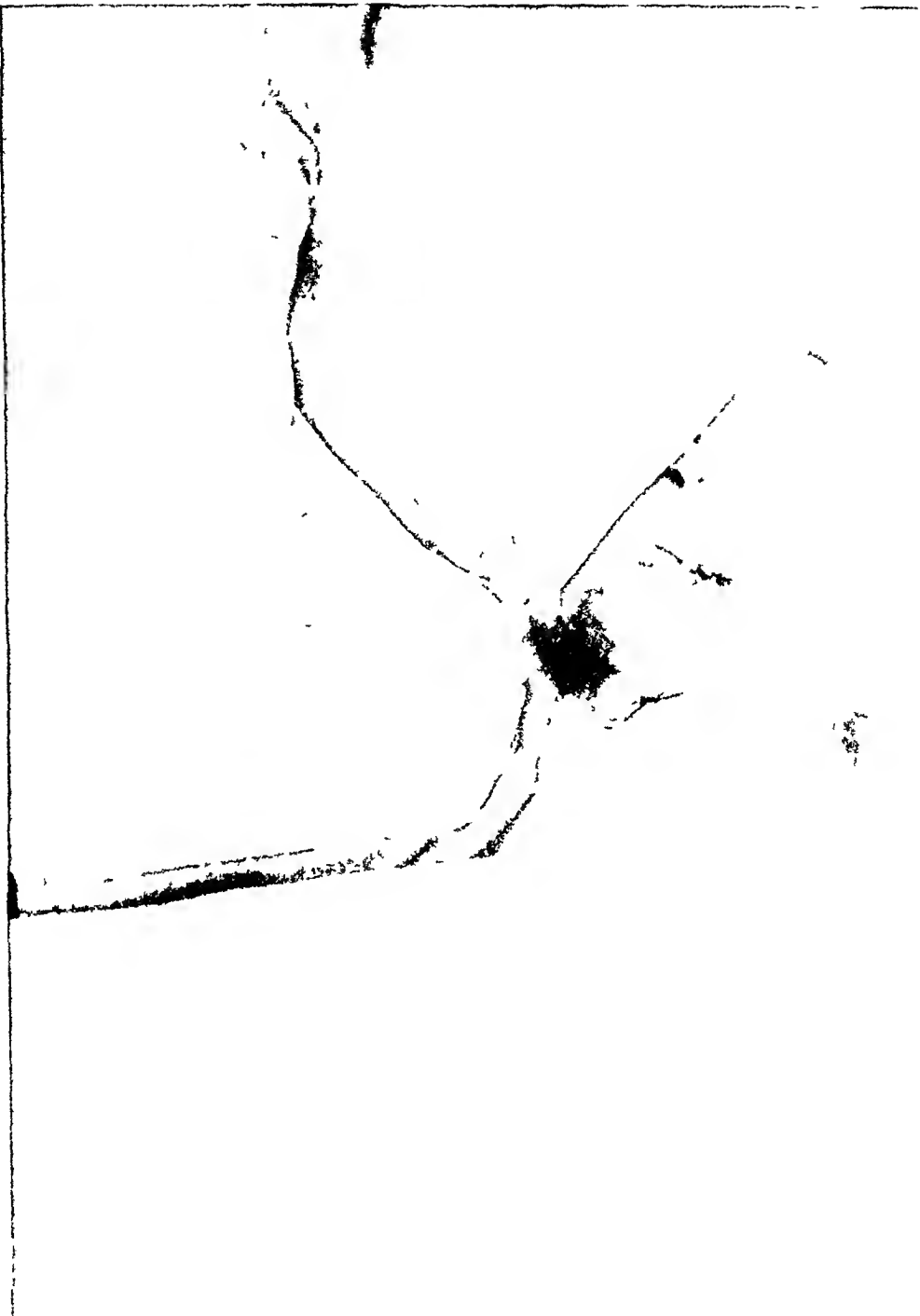


Showing lower extent of area from which nodes are removed. The internal clamp reaches to the point indicated by the point of the external clamp.

FIG 8



Photograph taken at the end of operation to show the extent of the exposure which is obtained through the transverse incision. The internal jugular vein passes prominently across the field.



Wound closed by subcuticular sutures Drain of silk worm gut strands introduced under the sternomastoid muscle emerging through a posterior counter opening

FIG 10



Photograph of patient one year after operation Two and a quarter years after operation he was shown at the New York Surgical Society without recurrence and with a scar even less noticeable than this photograph indicates

FIG 11

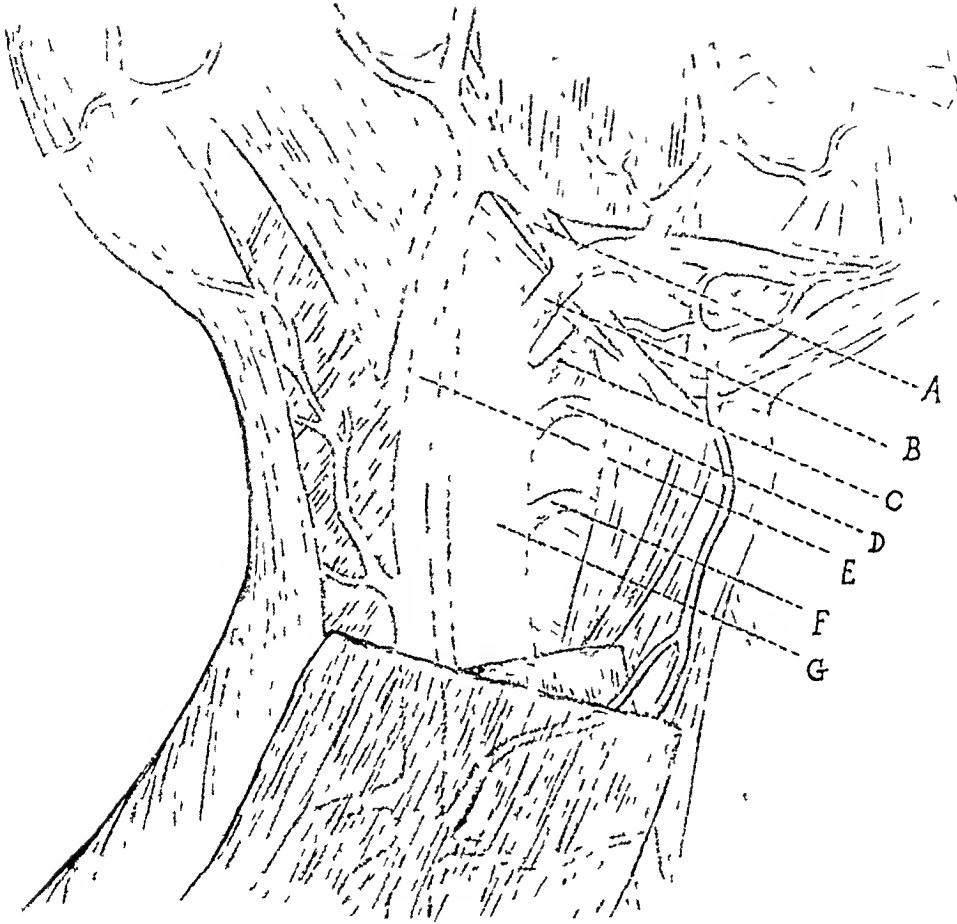


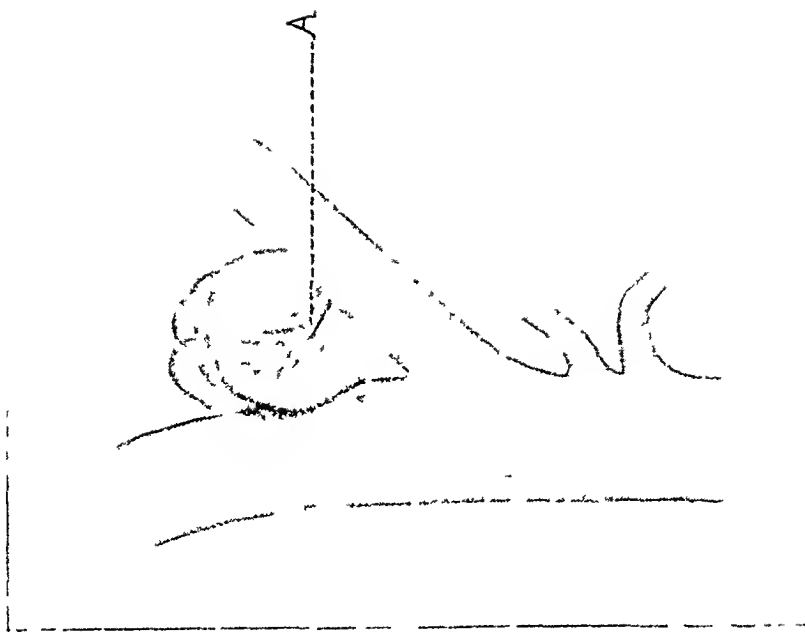
Diagram of veins of neck adapted from Gray's anatomy. Showing the location of the posterior facial vein (A) from which bothersome hemorrhage may easily occur. A, Posterior facial or anterior temporomaxillary vein. B, Common facial vein. C, Lingual vein. D, Laryngeal vein. E, External jugular vein. F, Superior thyroid vein. G, Internal jugular vein.

FIG 12



A, A, Inconstant branches, entering the internal jugular vein from behind where they may easily be injured

FIG 13



Small vein (A) running from lymph node into common facial vein where flattened by traction it resembles a node capsule. Its section near the main vein is practically a wound of that vessel

practically an injury of the internal jugular. If it should occur or if the internal jugular itself should be incised, the opening should be secured by one or more artery clamps and then included in an over-and-over suture of small silk, thus preserving the lumen of the vein.

The writer can report on 66 cases which, in condition of lymph nodes and type of operation, may be classed with the one here figured. These patients all recovered from the operation within a reasonably short time. There was only one serious complication in their number—a secondary hemorrhage from the internal jugular vein, which occurred in an infected case on the ninth day after operation. It was controlled by pressure, but to avoid its recurrence the vein was ligated above and below, and prompt healing followed.

The later history of these cases has been followed with much care. One has been followed nearly five years from the time of operation, 12 have been followed into the fourth year, 9 into the third year, 18 into the second year, 15 into the first year, 12 have not been observed since leaving the hospital.

The appearance of these cases as they have been examined at various periods after operation has been almost uniform. There are usually a few small superficial nodes in the posterior chain which are just palpable, hardly larger than peas. The tonsillar node on the other side of the neck is usually about the size of a lima bean, otherwise no enlarged nodes can be felt. These enlargements are, I believe, hyperplastic and not tubercular, due probably to the increased demand which is made upon the nodes after the removal of so many others.

I have watched nodes of this kind year after year and have hardly ever seen them increase in size, and have frequently seen them subside. A few of them have been removed and almost without exception have been found to be hyperplastic.

Among these 66 cases there are three who have filbert-sized nodes which may be regarded as recurrences. In a

fourth one a discharging sinus appeared in the wound area, it closed spontaneously, he also had a node removed from the parotid gland by operation. No doubt there will be some other recurrences among these 66 patients, but the present report of only four known recurrences is surely very encouraging, and indicates that there is a large class of these early cases for whom an operation may be done which is safe and thorough, which hardly leaves a scar, and which is followed by a very large proportion of cures. These favorable cases are found more often among the well fed and well housed people, particularly children, than among those less fortunately situated.

The report of this type of early cases should be accompanied by a brief report of all the writer's cases, extensive and otherwise. There are 256 of them. There was only one operative death in the entire number, it occurred in a very unfavorable case, from secondary hemorrhage from the internal jugular. These cases have been followed for long periods, varying from 12 years down. The exact details are not now in available form and will be given in a later report, but they bear out the indications of the report made in 1905 of between 75 and 80 per cent of apparent cures, and many other cases who will probably be cured after further operations.

DESMOID TUMORS OF THE ABDOMINAL WALL

BY HARVEY B. STONE, M D,

OF CHARLOTTESVILLE, VA,

Adjunct Professor of Surgery in the University of Virginia

THE term "desmoid" was first used by Johannes Mueller¹ with application to certain tumors of connective tissue origin, and as the name implies, of "tendon-like" consistency, arising from the abdominal wall. These tumors are so unusual, and present such interest and possible difficulty in diagnosis, that the recent occurrence of a case in the clinic of Dr. Watts, at the University of Virginia, suggested the advisability of placing the case on record, with a brief résumé of the literature of the subject.

It is well, first of all, to determine what shall, and what shall not be included under the term desmoid. There have been some who would so classify the fibro-myomata of the round ligaments arising in the canal of Nuck, but essentially analogous to the ordinary uterine myomata. Similarly, the tumors to which attention was called by Nélaton,² arising from the bony pelvis and invading the abdominal wall, have been considered desmoids, but the weight of opinion is decidedly toward excluding these classes of tumors from the category of true desmoids. The conception of Pfeiffer,³ which is also that authorized in v. Bergmann's "*Handbuch der Praktischen Chirurgie*," would restrict the use of the word "desmoid" to fibromata or fibro-sarcomata arising from the musculo-aponeurotic structures—muscles, muscle-sheaths, aponeuroses, *lineæ transversæ*, etc.—of the abdominal wall itself, thus excluding tumors originating in the bony pelvis or the round ligaments, as well as those springing from the skin or subcutaneous tissues.

In reviewing the literature, one is struck by the fact that the great majority of the articles on the subject are reports of single, or at most, three or four cases. There are, however,

two prominent exceptions to this general rule, in the monographs of Ledderhose⁴ and Pfeiffer³ The first of these writers has collected 100 cases from various sources, the second reports 40 cases of his own, to which he adds 360 more cases collected from the literature, including the 100 cases of Ledderhose already mentioned, thus making a total of 400 cases in all So thoroughly has the last author worked over the literature up to the date of his publication, that we feel it unnecessary to do more than refer the reader to this article with its voluminous bibliography, for work done before 1904 Since that date, we have been able to collect the following cases, which we report here in brief abstract

CULLEN⁵ Mrs N M, 30 years old No note of pregnancy Tumor in left hypochondrium Tumor lobulated and freely movable At operation it was found to be attached to the sheath of the abdominal muscles, and in removing it, some of the muscle was taken out with the tumor Pathological report pure fibroma

SCHWARZSCHILD⁶ Case I Woman 28 years old Tumor present in right side of abdomen for 2 years, growth very slow For past half year, following directly upon labor, growth has been more rapid Tumor is now the size of a child's head, hard and nodular, and attached to abdominal wall Diagnosis fibroma At operation, the tumor was found to be closely adherent to peritoneum and a large defect was left by its removal, which was closed by a plastic operation After one year, no recurrence, no hernia Pathological report not made

Case II Woman, 30 years old, mother of two children In the right lower quadrant of abdomen is a tumor, the size of a hen's egg, which is attached to abdominal wall, but not adherent to the skin At operation the tumor was found to spring from the posterior surface of rectus, but was not adherent to peritoneum, which was not opened Diagnosis desmoid

EITEL⁷ Mrs J, aged 26 years Tumor above and to left of symphysis pubis, of 10 months' duration and slow growth Slight pain Tumor size of fist, hard, encapsulated, deeply embedded in abdominal wall At operation, tumor was found just beneath external oblique muscle, involving all the structures down to the peritoneum, to which it was adherent Apparently tumor originated from fascia transversalis Good closure without plastic Patient now well Pathological report very cellular fibroma

GROSS AND SENCERT⁸ Woman 73 years old Tumor of 10 years' standing, arising to left of middle line and occupying whole left half of abdomen Tumor very large, weighing 6 kg, and extensively ulcerated Patient in condition of septicaemia Tumor found at operation to be

attached by pedicle to the anterior sheath of rectus, and originating at the position of one of the lineæ transversæ Pathological report partly gangrenous lipo-fibroma

ECCLES⁹ and BEDWELL¹⁰ report several cases of fibro-sarcomata of the abdominal wall, and another case is reported by TAPIE and DAUNIC¹¹ but the writer was unfortunately unable to gain access to these articles

Besides these cases, five others have been collected from the surgical service of the Johns Hopkins Hospital, for the permission to use which we wish to thank Dr Wm S Halsted and Dr Jos C Bloodgood of that institution These cases were grouped under the caption "tumors of the abdominal wall," and were collected from a general surgical service now exceeding 21,000 cases of all kinds The abstracts follow

CASE I—A man, aged 27, with tumor just below umbilicus in mid-line Duration 6 years During the past 5 months, more rapid growth has been observed Tumor is hard, smooth, just under skin, freely movable Tumor easily enucleated No statement as to attachment of tumor to deep structures Microscopically, the tumor is composed largely of spindle cells

CASE II—Woman, aged 56 Has borne a child Shortly after labor, a painless, slow-growing tumor appeared just to left of umbilicus Tumor was incompletely removed, the wound became infected, and healed with a large scar For the past 20 years there has been a gradual recurrence in this scar, the tumor involving the skin For five years, the tumor has been ulcerated, which patient attributes to trauma Lately two small secondary nodules have appeared in skin to right and left of original growth Tumors are hard, freely movable on deep structures, but firmly fixed to the skin Tumor easily removed, and no note made of any attachment to deep structures Pathological report spindle-celled tumor

CASE III—Woman, aged 23 years, with tumor of 6 months duration, onset following pregnancy Tumor to the left and below umbilicus, is palpable but not visible Tenderness prevents accurate palpation, or definite outlining of mass Fixed to deeper structures At operation, tumor is found to be attached to posterior surface of the sheath of rectus

CASE IV—Woman, aged 35 years, with rapidly growing tumor of the right lower quadrant of abdomen, following pregnancy No pain Tumor is hard, nodular, with skin freely movable, and itself movable on deep parts At operation, tumor is described as subcutaneous, but note states that part of rectus had to be removed with it, because of its firm adherence to the anterior sheath of that muscle

CASE V—Colored woman, aged 18 Tumor appeared during pregnancy, to left of and just below umbilicus Only a few months duration

Tumor is hard, somewhat nodular, and seems to be beneath rectus sheath. At operation, tumor is found under the anterior sheath of rectus, and infiltrating the muscle. Pathological report spindle-celled sarcoma.

At this point we would enter a brief commentary upon these five cases. Case I may or may not have been a desmoid. Neither the clinical findings, nor the operation note, make clear its point of origin, and it may perfectly well have been an ordinary subcutaneous fibroid nodule. It must bear the verdict "not proven." Case II similarly is not above suspicion. Whatever the nature of the primary growth, which was incompletely removed long before the patient sought the hospital, the recurrence in the scar certainly bears much closer resemblance to a keloid or sarcoma of the skin than to a true desmoid. As to the last three cases, we can undoubtedly regard them as cases for inclusion in the class of tumors under consideration. We would like to draw attention to Case V, as far as we know a unique example of true desmoid in the negro, contrasting strongly with the frequent occurrence in this race of the keloid, a tumor certainly very closely related to the desmoid.

Finally, we have to add to the cases here compiled, one which has recently occurred in our own clinic, and which led primarily to this review of the subject.

MRS. A. G., widow, aged 23 years, entered the hospital complaining of an abdominal tumor. Her family history is of no importance. The striking fact in her past history is the instrumental delivery of a still-born child, said to have been unusually large. This was the only pregnancy. The present illness began seven months ago, when patient noticed a lump in the left half of the abdomen. There has been no apparent growth since discovery. No pain or other subjective symptoms of any kind. On examination, the patient's general condition is excellent. No organic lesions. Patient quite stout. Abdomen is full, soft, with thick fatty walls. Nowhere tender. About 2 cm. to left of the umbilicus, there is an ill-defined, deep-lying, ovoid mass, measuring about 8 cm. x 5 cm., with its long axis parallel to the fibres of the rectus. It is firm, smooth, and the skin over it is freely

movable The mass itself moves with the abdominal wall No apparent connection with the pelvis, or the internal genitals Vaginal examination throws no light on the nature of the tumor No other masses anywhere

A definite diagnosis was not made The very thick abdominal walls gave the impression that the tumor was intra-abdominal,—in fact it was partly so,—and the possibility of an omental or mesenteric growth, perhaps with adhesion to the anterior abdominal wall was considered

At operation, the tumor was found to be a desmoid, arising from the posterior sheath of the left rectus, involving the entire thickness of the muscle, and the median two-thirds of its width The greater mass of the tumor projected backward into the abdominal cavity, to such an extent that the bulk of the tumor was intra-abdominal, and was firmly adherent to the peritoneum In excising the growth, a piece of peritoneum 4 x 5 cm was removed with it The abdominal contents were normal Closure was effected in layers, and a strong repair made without the necessity of any plastic measures Pathological report very cellular fibroma

In reviewing the cases above reported, with those collected by other authors, certain salient features have been observed in regard to desmoids, which are commented upon by all the writers on the subject These characteristics we will proceed to outline, using Pfeiffer's work freely for statistics

Pathology —These tumors are of connective tissue origin and spring from the musculo-aponeurotic structures of the abdominal wall In the gross they are hard tumors, occasionally with areas of softening from cystic degeneration, smooth or slightly nodular in outline, cut with a crisp grating, and on the cut surface present a dense fibrous structure Microscopically the majority of specimens present the typical picture of a more or less cellular fibroma In a certain number of cases, careful sectioning shows areas of sarcomatous change, and a few are pure sarcomata Other variations occasionally met with are tumors presenting areas of myxomatous or

hemorrhagic degeneration. These facts have led to the use of various compound names, *ie*, fibro-myxo-sarcoma, etc., but the best authorities sustain the practice of Sanger who groups all these tumors under the one term desmoid. The former generally accepted belief in the rarity of malignant tumors of this class has been considerably modified by the statistics of Pfeiffer³ in whose tabulation 10.6 per cent of the cases in women and 24.4 per cent of those in men were sarcomata. This large proportion of malignant cases in the male is worthy of note, as is also the curious fact, that the clinical and microscopic evidences of malignancy show less harmony in this class of tumors than perhaps any other. Tumors which show rapid growth, invasion of neighboring parts, and pain, not infrequently are pure fibromata; whereas, on the other hand, clinically benign, quiescent growths may present typical fields of sarcoma under the microscope.

Incidence—The rarity of these tumors may be appreciated from the statistics of Guerlt, obtained from the Vienna hospitals, 13 per cent of desmoids in 16,637 tumor cases. Perhaps the most striking peculiarity of the desmoid is the preponderance of its occurrence in women, and particularly parous women. Not infrequently the tumor is first discovered during pregnancy or the puerperium. To have recourse again to Pfeiffer's figures, he shows that 87.1 per cent of his cases were in women, and that 94.3 per cent of the women had borne children. The tumors may occur at any age from 1½ to 81 years. In fact, a rare case or two, considered congenital, is on record. The period of life of greatest liability is from 25 to 35 years in women and 35 to 50 in men.

Location—The most frequent position of desmoids is in the right lower quadrant of the abdomen. The anatomical structure from which they most frequently arise is the rectus abdominis muscle, or its attachments, sheath, lineæ transversæ, etc. Next in order of frequency come the external oblique muscles, the fascia transversalis, and the lineæ alba. A characteristic of the tumors, which are usually ovoid, is that their long axes are nearly always parallel with the direction of the

fibres of the muscle in which they are growing, so that desmoids in the middle of the abdomen lie longitudinally, whereas those in the flanks are transverse. Nélaton² believed that these tumors frequently originated from the bony pelvis, and that most of them were connected with it by a fibrous pedicle, but Guyon¹² has shown that such a connection either does not exist at all, or is simply a band of fascia under tension. Desmoid tumors are solitary, at least, multiplicity has never been proved.

Etiology.—The peculiarities of desmoids have led to much speculation and discussion as to whether they may not have some special causation aside from those factors that may lead to tumor growth elsewhere. The fact to which attention was drawn above, namely, that pregnancy seems to bear some relation to the incidence of these neoplasms, and the further fact, that many cases occurring in men or nulliparous women, give a history of preceding trauma, has furnished ground for much speculation. Herzog¹³ and others support the theory that during pregnancy or parturition there is a rupture of the structures of the abdominal wall that leads to a fibrous scar or a hematoma. This scar or organizing hematoma is conceived to be the starting point of a desmoid, in much the same way as a skin scar is the starting point of a keloid. Others have supposed that the stretching of the muscles of the belly-wall during pregnancy plays an important part in the process, and explain the striking absence of desmoids in cases of distention from ascites, ovarian cysts, etc., on the ground that in these conditions the blood-supply to the abdomen is impaired, and the general nutritive resources of all the tissues is low, whereas in pregnancy, just the reverse is the case. Certain experimental work on pregnant and ascitic animals lends color to this reasoning. But while pregnancy may present favorable conditions for desmoid formation, the not infrequent occurrence of such tumors in cases with no history of either pregnancy or trauma, makes it probable that there is some other more important factor in the etiology, and the general belief is that the cause of desmoids will be explained only

when the mystery, that as yet enshrouds neoplasms in general, is finally solved

Clinical Course—In the majority of cases, the patient accidentally discovers the existence of the mass. Pain or subjective symptoms of any kind are unusual, if the growth be quite large, there may be dragging, aching sensations, or the tumor if large and properly situated may give rise to visceral disturbances from pressure, the bladder being the organ most frequently involved. The tumors, when first discovered, are usually from about the size of a hen's egg to that of a clenched fist. In most cases growth is slow, possibly imperceptible. Calcification may put a stop to the progress of the tumor. In some cases, however, growth may be quite rapid, the tumor reaching the size of a child's or even an adult's head in a few months. Recession and spontaneous disappearance of a true desmoid has never been observed. The larger tumors, particularly if projecting anteriorly, are liable to traumatism or friction from the clothing, and as the skin over them is tense and thin, with dilated veins, conditions favorable for ulceration exist. When this occurs, a portal of entry for infection is of course opened, and death from this cause is a well recognized termination of large desmoids.

The lymph glands usually are not involved unless the tumor is of a most malignant type. As has been stated above, clinical indications that suggest malignancy, such as recurrence after apparently complete removal, or invasion of surrounding parts, may occur in tumors microscopically benign. It should be noted in passing that such "invasion" is really rather a pushing aside of the neighboring tissues, since although these tumors seldom have a definite capsule, they are well circumscribed, and neither clinically nor microscopically tend to diffuse permeation of the tissues, except in cases of pure sarcoma. Let me again, however, call attention to the figures given above regarding the frequency of sarcoma, particularly in men, and emphasize the mistake made in the past of attributing so little possibility of malignancy to desmoids.

Diagnosis—One would think there would be little diffi-

culty in recognizing these growths, and in many cases this is true, but where the patient has thick abdominal walls, and the tumor is deeply situated, it is by no means easy. A tumor springing from the anterior sheath of the rectus is usually easy to diagnose. Such a tumor, which is freely movable when the abdomen is relaxed, disappears or becomes fixed when the muscles are made tense by straining, or raising the head from the pillow without the help of the arms. From cases lying within the muscle, suppuration, hematoma, and cysts of various kinds have to be differentiated. The tenderness and other signs of inflammation usually render the first of these problems easy. Cysts may be diagnosed by aspiration, particularly if this possibility is suggested by fluctuation, which is not, however, always present in cysts. In deep lying hematomata with firm tense capsules the findings may be most confusing, but the fact that a hematoma either is absorbed or suppurates, whereas a tumor grows, will distinguish the two lesions if one has opportunity to observe the case for a time, or can secure a trustworthy history.

Lastly, and most difficult of all to diagnose, are those cases in which the tumors project posteriorly into the abdominal cavity. Here one has to consider the possibility of the tumor being of visceral origin, and if the walls be thick, palpation is most unsatisfactory. Tumors of the liver may be ruled out by the descent of that organ with inspiration. The spleen usually has a characteristic edge, but certain cases may be most confusing. Kidney tumors can usually be ruled out by the change in percussion and palpation following inflation of the bowel. Intestinal growths give rise to symptoms which are entirely unlike the desmoid picture, and are besides usually mobile and take up different positions. Finally, the rare tumors, especially sarcomata, of the omentum or mesentery, may present great difficulty, and indeed, if they are adherent to the anterior abdominal wall, the distinction may be impossible to make.

Treatment—The question of what to do for these growths, may be answered in two words *operate early*. The

not remote possibility of malignant degeneration in any tumor of this class is sufficient reason for such advice, but aside from this the direction of growth of many desmoids furnishes another strong reason. All of the cases which spring from the posterior wall and grow backward naturally become closely applied and adherent to the peritoneum. Furthermore, in their extension laterally they either cause pressure atrophy of the muscles, or push them aside. The longer such a condition lasts, and the further it extends, the larger defect is made both in the muscular and peritoneal layers, by the complete removal of the tumor. We have not space to describe the ingenious plastic methods employed in the closure of wounds by some of the surgeons who have removed large tumors, but we feel sure that one who has been forced to such resorts will afterward be a vigorous advocate of early operation. The chief factors that prevent perfect results are the occurrence of post-operative herniæ and recurrences of the tumor. That we may emphasize the gravity of the condition, we present the following statistics collected since the introduction of antiseptics

Mortality in laparotomy cases	35 per cent
Mortality without laparotomy	105 per cent

Recurrences in men	681 per cent
Recurrences in women	900 per cent

Final cure, surviving 1st and possibly 2nd and 3rd operations	
Men	50 per cent
Women	212 per cent

In conclusion, I wish to express my gratitude and appreciation to my chief, Dr Watts, for his stimulating support in the preparation of this paper

BIBLIOGRAPHY

- ¹ Johannes Mueller "Ueber den feineren Bau und die Formen der Krankhaften Geschwuelste," Berlin, 1838, 1 Lief S 60
- ² Nelaton "Gaz des hôpit," 1862, p 77

- ³ C Pfeiffer "Die Desmoide der Bauchdecken und ihre Prognose,"
Beitr zur Klin Chir, 1904, vol xlv, pp 334-401
- ⁴ Ledderhose "Die Chirurgischen Erkrankungen der Bauchdecken,"
Deutsch Chirurgie, 1890, vol 45
- ⁵ T S Cullen "A Fibroma of the Abdominal Wall," The Johns Hopkins
Hosp Bull, 1905, vol xvi, No 177
- ⁶ Schwarzschild "Bauchdeckenfibrome," Munch Med Wochenschrift,
1906, vol liii, p 1135
- ⁷ G G Eitel "A fibroid of the abdominal wall," Northwest Lancet,
Minn 1905, vol xxx, p 112
- ⁸ G Gross et L Sencert "Enorme fibro-lipome de la paroi abdominale,"
Rev de l'est, Nancy, 1905, vol xxxvii, pp 408-410
- ⁹ W McA Eccles "Three cases of fibro-sarcoma of the Muscles of the
Abdominal Wall," West London Med Jour, 1906, vol xi, pp 222-24
- ¹⁰ L A Bedwell "Two cases of Fibro-sarcoma of the Abdominal Wall,"
West Lond Med Jour, 1906, vol xi, p 224
- ¹¹ Tapie et Dauc "Sarcome fusocellulaire de la paroi abdominale,"
Toulouse Med 1906, vol viii, p 25
- ¹² Guyon Gaz hebdom 1872, 2 series xiv, p 325
- ¹³ Herzog "Über fibrome der Bauchdecken, Muenchen 1883 (V1, H1
83, 11, p 414.)

NOTE ON SYPHILIS OF THE LIVER.

WITH A REPORT OF THREE CASES IN WHICH OPERATION WAS RESORTED TO

BY ARCHIBALD MacLAREN, M D,

OF ST PAUL, MINN

Professor of Clinical Surgery in the University of Minnesota

ACQUIRED syphilis of the liver in its tertiary stage assumes three distinct microscopical types First, when the eruption shows itself in the form of white milky patches, irregular star-shaped in form, due to an inflammation of the Glisson's capsule as first pointed out by Virchow Second, single gumma, frequently large and usually on the anterior surface or along the anterior border of the liver Third, multiple gummata which appears to be the more frequent form, varying in size from a small bird-shot to an English walnut

As Rolliston says, "The right lobe is much more often affected, and the anterior surface far more frequently than the under aspect In eighty-six cases of hepatic gummata collected by J L Allen, only eleven were single It is said that the neighborhood of the falciform ligament is a favorable situation for gummata" But Rolliston has not noticed any such tendency except for the anterior surface

The gross appearance of old gumma presents raised tumors irregularly nodular with three concentric zones,—the centre yellow and softened, the middle one whiter, more resisting, and elastic, the third or exterior, a fibrous shell

The first form is perhaps the early manifestation of commencing sclerosis with which it is sometimes associated Maurice describes this type as sclerogummata The differential diagnosis between carcinoma of the liver and the larger gummata is often difficult The syphiloma is smoother and not quite so nodular in feel, and is usually of a yellower color

Primary carcinoma of the liver is rare, it is more rapid in its course, and the patient is usually sicker than with syphilis, and, as Cumston says, "Enlargement of the spleen favors

syphilis " Multiple gummata of moderate size may also closely resemble carcinoma in its secondary stage, while the smaller syphilides may at times resemble miliary tuberculosis

Syphilis is sometimes mistaken for cirrhosis of the liver In such cases hæmatemesis, dilated veins in the abdominal wall, ascites, and dyspepsia are less frequently seen than in cirrhosis When ascites is due to cirrhosis the patient is thinner, while in syphilis the general nutrition may be fairly preserved In cirrhosis, if the liver is enlarged, it is usually more symmetrical than in syphilis, for in the later condition there is usually an irregular enlargement As the iodides are frequently given in cirrhosis, some of the reported cures of this disease may have been due to a mistaken diagnosis In all three of these types the diagnosis may have to be settled by a course of antisyphilitic treatment or by the removal of a piece of the tumor for microscopical examination, as was done in two of the cases reported below

Symptoms—It is quite surprising how many of the fifteen cases of syphilis of the liver already operated upon and reported by Keene and Cullen give no previous history of syphilis, nor any of the ordinary evidences of tertiary syphilis aside from the liver condition itself In most of the reported cases the statement is made that they have not had the ordinary primary or secondary symptoms of syphilis, that they have not had primary sores, skin disease, falling of the hair, chronic sore throat, rheumatism, and that there is no enlargement of the glands It seems to me that there are two possible explanations,—the first, that there are so many extra-genital primary sores which are not recognized as syphilitic, and, second, that the cases giving the ordinary symptoms have been properly diagnosed and treated, thereby preventing the later liver symptoms, or, if a certain case has had the ordinary primary and secondary symptoms, the later tertiary liver troubles will be much more easily diagnosed and the proper treatment instituted, thereby avoiding, perhaps, the necessity of an exploratory operation

Of the cases which have come to operation, many have

given only slight symptoms of any kind. The patients have looked well and have only suffered mild distress in the epigastric region, there has usually been a jaundice for several weeks with a temperature of about 100° F, loss of flesh, and some enlargement of the liver. In several with a distinct tumor which felt like an enlarged gall-bladder, and in a few with a small ascitic accumulation. Many of these cases have had colic, like biliary colic, and if associated with enlargement and tenderness in the gall-bladder region, it is not surprising that they have been mistaken for gall-bladder cases.

Treatment —If syphilis of the liver is suspected, a course of antisyphilitic treatment, especially large doses of the iodides, should be given, and will cause a cure in a large proportion of cases. From fifteen to thirty grains of the iodides of potassium and sodium *t i d* combined with mercurial inunctions, or, in acute cases, intramuscular injections of the mercurial salts. But, in spite of large doses of the iodides, some cases of large gummata will not disappear. Such cases are recently reported by Mr R. Parks and Dr Garrod.

This brings us to the question of the operation. Auschultz and Hans Kerr think that even after exploration, if syphilis of the liver be found, the wound should be closed and the patient be put upon antisyphilitic treatment. This position is undoubtedly correct in all cases except where large gummata are found, for these are the cases which persist in spite of treatment. My own experience, when viewed in the light of the reports made by Keene, Robeson, Mayo, and Freeman in removal of large tumors of the liver of various kinds, makes me feel that the surgery of the liver is just commencing, that it is a fruitful field, one that we have shunned on account of the fear of hæmorrhage, that many of the tumors of the liver which we have universally abandoned can be safely removed to-day.

Hunbald reports ninety-six cases of resection of the liver, being all of the cases reported in the literature that he could find, with a mortality of 26 per cent. This includes Keene's list with a mortality of 15 per cent, while Cullen, who has

tabulated all of the cases since Keene's reports finds seventeen with two deaths, or a mortality of 11.7 per cent. But to return to the surgical treatment of gummata. I find ten cases of either complete or partial removal of large gummata, including my own case, with two deaths, both of these deaths were treated by the elastic ligature method, making a mortality of 12.5 per cent.

The removal of gumma helps in the cure of any case because there is much less tissue to be absorbed. If antisyphilitic treatment was certain to absorb all gummata, then the risk of removal would not be justifiable. But as it will not always absorb large gumma, and as the diagnosis is not always certain from gross appearance of the growth, removal is justifiable.

Keene favors the removal of tumors with a red-hot cautery knife, tying the large vessels separately with catgut. Mayo reports one case successfully treated in this manner. The constriction of part of the liver with an elastic ligature behind hat-pins has been successful in a few cases, but is also responsible for some of the late deaths. Konsnietzoff's blunt needle with double catgut, as used by Mikulicz, is perhaps the best method of controlling the hæmorrhage after removing the tumor. Gauze tamponing of the raw surface, especially after the use of the cautery, is an additional precaution in preventing hæmorrhage.

CASE I.—A patient seen in consultation with Dr. Herbert Davis. This man was forty years of age, who denies syphilis, and has not had, nor does he give now, any signs of syphilitic infection. He had been suffering with indefinite pains through the right upper abdominal cavity, with a moderate enlargement of the liver, first noticed six weeks ago. He had been suffering with attacks of colic for the past three months, with some loss of flesh and strength. On exploration, December 12, 1903, I found an enlarged liver, its upper surface covered with white star-shaped patches, while its under surface presented several hard, white nodules from the size of a plum to a pea. One moderate sized nodule near the anterior surface was removed and the wound sutured with catgut, the end of a gauze drain being attached to

the liver Two microscopical diagnoses were made, one for carcinoma and one for gumma After exhibition of the iodides, the enlargement of the liver disappeared, and the man gained twenty pounds in three months As he has remained perfectly well, now over two years since the operation, it is reasonable to conclude that the diagnosis of carcinoma was not correct

CASE II—Large gumma of the anterior border, operated upon four and a half years ago Mrs B, seen with Dr Jeanette MacLaren in December, 1900, thirty years of age, mother of three healthy children, aged seven, six, and three, respectively These children show no evidence of hereditary syphilis, but are not a very vigorous type Five years before was treated by Dr Schadle for some throat trouble, after operation, which I am here describing was performed, it was discovered that at this time she had a perforation of the soft palate, which quickly healed after a course of iodides One year before I saw her, Dr Charles Greene treated her for pulmonary tuberculosis Tubercle bacilli were found in the sputum Under treatment, her weight improved in three months from 107 to 120, and the tubercle bacilli disappeared from the sputum Dr MacLaren had treated her for chronic pelvic disease and general anæmia, which always promptly responded to local treatment and Bland's pills The abdominal growth was first noticed in August, 1900, which was not tender at any time In October she became quite anæmic, although the blood was not changed, red corpuscles normal, no increase of white cells Temperature was from 100° to 101° F

Operation, December 6, 1900 A large white tumor on the anterior border of the left lobe, overlying the gall-bladder, the size of a man's fist, not pedunculated, extensive adhesions to the omentum This tumor was removed, with at least one inch of normal liver substance, with a knife after an over and over catgut suture passed with a large, curved, round pointed needle constricting the same tissue more than once, when it showed a tendency to bleed Iodoform gauze-drains were packed against the large raw surface left after removing the growth This woman promptly recovered, and has remained perfectly well, now four and one-half years since the operation She has had iodides since the operation on several occasions Dr Westbrook diagnosed gumma

CASE III—Mrs L, seen with Dr Sweeney Patient is

thirty-six years of age, married sixteen years. Soon after marriage she had an attack of inflammation of the womb, was a patient of Dr Sam Johnson, of Hudson, and was treated by him for several years at his sanitarium for chronic pelvic trouble and a chronic cough. Her first child was born dead, but was perfect and not apparently diseased. Later she was quite well for seven years. The second child was born six years ago, and has always been a healthy child. Present trouble commenced two years ago with pain in the region of the stomach and occasional attacks of vomiting and chronic soreness in the epigastric region. She has never had any symptoms suggestive of syphilis. Five weeks ago she first noticed a lump just above the umbilicus, continuous with the edge of the liver. Exploration on April 7, 1905, demonstrated a uniformly enlarged liver, covered with hard, white, irregular nodules, each about the size of a silver half-dollar. Fully thirty such nodules were seen and felt in both lobes, equally distributed in both the upper and under surface of the liver. No larger mass was found in the abdominal cavity. A section of one of these lobes was removed and the cut edges were united with catgut sutures. There was a very slight accumulation of ascitic fluid. This woman recovered promptly, and left the hospital improved under iodides, but with some ascitic fluid in the abdomen. She has gained fifteen pounds, ascitic fluid had decreased.

Dr Hines and Dr Rothrock report that the growth is a gumma

PRIMARY CARCINOMA OF THE VERMIFORM APPENDIX.

BY LEVI J HAMMOND, M D,

OF PHILADELPHIA, PA

Surgeon to the Methodist Episcopal and Maternity Hospitals

THE relative rarity of primary carcinoma of the vermiform appendix, compared with its rather frequent occurrence in other parts of the viscera, is sufficiently striking to make every case of sufficient interest to record

History—The vermiform appendix seems not to have been recognized as the possible seat of primary carcinoma, until Merlin, in 1838, first described a case. From this time it began to be referred to in literature, the older writers holding the opinion that neoplasms of this body were always secondary. Prien, in 1865, recorded one case, and two years later Rokitsky reported four cases of colloid tumor of the appendix. Up to 1895, but twelve cases had been reported, and out of this number one only had been histologically described, seven of the total number were discovered post-mortem. During the past ten years the number of cases reported has been greatly augmented. In 1903 forty cases were collected and reported to the New York State Medical Society. There are now on record about sixty-one cases that appear to be undoubted instances of primary carcinoma of this body, nineteen of these cases have not been confirmed by pathologic examination, there are also eight instances of primary sarcoma. While the classifications of the malignancy of some of the cases reported were undetermined by microscopic examination, they conform so closely to the description of those that have been studied, it is, I think, logical to place them in the same category.

Clinical History—There is a striking absence of that chain of symptoms that goes to make up the picture of malignancy as usually met with. The most noticeable is the very

early age at which it has been found. The youngest was a girl of 12 years and the second was a girl of 15 years, while none seem to have been found in subjects past 40 years. Females are more often subjects of this malignancy than males. The patients are attacked with symptoms identical with those of the inflammatory type of appendicitis and the course of the attack throughout in no way differs from it except in the marked lessening in acuteness of the majority of the symptoms in by far the greatest number of cases, while on the other hand a few instances are recorded which serve to illustrate the possibilities of most acute symptoms. These are shown in a white girl 17 years of age, whose second attack came on after an interval of one year, with unusually severe pain, nausea and vomiting. With few exceptions the course of the attack is chronic, recurring at intervals of months or weeks, one of them extended over a period of seven years.

In but two instances has the neoplasm been associated with suppuration, and in one case of this type operation was done during the second attack, which was three weeks after the first had been complained of, the appendix in this case was acutely inflamed and the lumen contained pus.

In a number of instances the attack has been ushered in with no graver symptoms than those usually described as "acute indigestion" without any increase in temperature or pulse rate beyond normal, the extent of subjective symptoms in some cases being limited to pain only on deep pressure. The objective symptoms, however, in many of the cases, seem to be distinctly suggestive, there being noticeable evidence of impaired nutrition and assimilation, as shown in general anemia with some loss of flesh and pronounced lassitude, without any particular noteworthy change in the pulse rate or temperature, though the striking absence of classic constitutional symptoms, such as cachexia, has not even led to the suspicion of the nature of the disease before operation. This leads to the belief that malignancy of this organ *per se* does not carry with it any clinical symptoms that will define its true character. Probably the most misleading factor in the clinical

history is the varying periods at which recurrent attacks have been reported. One case, for example, a female aged 30 years, had recurrent attacks which extended over a period of seven years, while in another case, also a woman, 24 years of age, the illness dated but two days, while in still another case, that of a colored boy, aged 19 years, the only symptoms were repeated attacks of abdominal cramps.

Ætiology—It seems probable, both from the study of the recorded cases as well as observations made by myself in this single instance, to regard these malignant changes in the appendix as secondary to the catarrhal form of inflammation, and that the transition from the simple inflammatory conditions to that of malignancy is not marked by that chain of symptoms usually described as belonging to primary malignancy.

Arguing, therefore, from analogy and from the well-known association of carcinoma with chronic inflammations, and commenting upon the rarity of tumors of the appendix, as compared with the frequency of its inflammatory affections, it seems logical to conclude that neoplasms of this organ are in a greater number of cases secondary to simple inflammation, especially should this be true in the milder forms of appendicitis, but it could not hold good in those acute inflammatory ones which culminate in abscess. In several of the recorded cases there was a definite stenosis which seems to have been a primary factor.

Symptoms—The fact that carcinoma has been found in this body in persons dying from disease other than that of the appendix, clearly emphasizes the fact that neoplasms may exist in this organ without producing any symptoms directed toward it. Not only are the symptoms during the attack atypical but at no time throughout its existence does it develop any tangible evidence of its true nature. The attack is usually ushered in under precisely the same conditions and in like manner to that of the milder inflammatory forms. The patient will complain of diffuse pain, localizing itself to the right iliac fossa, nausea and vomiting, some soreness, most

pronounced to the right of the hypogastrium, rigidity and palpable tumor, with the usual history of recurrence and with intervals of freedom from symptoms, together with a decided variance in pulse and temperature record

Gross Pathology—The appendix, as in the ordinary inflammatory forms, is more often than not adherent at some point to the parietal peritoneum or to the intestines, more often at or near its tip. It is also greatly enlarged, dumb-bell shaped, and at its distal end is fibrously hard, considerably enlarged and definitely circumscribed, so much so that it may readily be mistaken for a small fibroma, it cannot be shelled out, and in places the margins generally merge into the surrounding tissues. The cecum, the ascending colon, and the ileum have been found to show decided inflammatory changes. In a few cases the mesenteric glands were found to be of unusual size. So greatly enlarged were they in one case that the anatomic diagnosis was tuberculosis, the external surface of the neoplasm is generally very smooth and rather devoid of appearance of acute inflammation.

The appendix in one case reported, that of a girl 14 years of age, was twisted upon itself and firmly bound down, presenting two constrictions between which was a round nodular neoplasm about the size of a small marble, yellowish-white in appearance. Again the tumor may be small, acutely inflamed, and the mucosa deeply ulcerated, with the lumen of the appendix obstructed by the growth. In some cases it is more or less spheroidal, and in one instance it was found the size of a sickle pear and not unlike it in shape. In none of the cases has ulceration to the extent of perforation been noted.

Carcinoma of this part of the body seems to seldom, if ever, give rise to secondary deposits, as the literature does not record a single instance of metastasis. In all cases in which locations of the growth have been referred to they are shown to be situated at or within four or five millimeters of the tip. This observation holds good for more than half of them; indeed, in only eight or ten cases was it found near the cecal

end, while in one case only was it found that the neoplasm extended within the cecum. The original focus of this one was, however, demonstrated to have had its origin in the appendix. The size of the growth varied from 5 to 15 millimeters.

Diagnosis—From the history of this condition it is obvious that the diagnosis cannot be made until operation and microscopic examination has been made. It is, however, just possible to strongly suspect the true character of the condition, if in a young subject there has been repeated acute attacks more or less insidious extending over a period of months or years, with decided loss of body weight and strength and with abdominal walls sufficiently thin to enable a fibrous hard tumor to be outlined, thought should be given toward its malignant nature.

Prognosis—Every case operated has made perfectly normal recovery after the removal of the neoplasm, with restoration of the body weight and strength.

CASE RECORD—The subject of this report, Patrick G., was an adult male aged 35 years with negative family history, referred to me by Dr. Stewart Runkle while suffering in his eighth attack, the first of which dated back 13 months.

The attacks during these intervals had recurred from 1 to 3 months apart, though the patient complained that he was never at any time since the first attack entirely unconscious of the existence of pain or discomfort in the right side of the abdomen and especially was this annoying after taking food. He also had with these attacks occasional vomiting, with periods of constant nausea, some elevation of temperature, with little or no increase in pulse rate, and obstinate constipation. The abdomen was distinctly scaphoid, the peristaltic wave was readily discernible through the thin abdominal wall with possibly slight convexity over the right iliac fossa.

Deep palpation was necessary before any tenderness could be elicited. A small hard pulsating mass could be readily outlined on deep palpation.

Urinalysis negative.

Operation July 30, 1907, under ether anaesthesia. The

abdomen was opened through a right lateral incision $2\frac{1}{2}$ inches in length over the usual site. The omentum and intestines visible through the incision were apparently in every way normal, on passing beneath them a stony-like, definitely circumscribed mass could be readily felt, which was so firmly anchored to the parietal tissues directly across the external iliac vessels, that their pulsation transmitted to the finger, over the growth, an impulse at first not unlike that of aneurysm. There were no mesenteric gland enlargements, the surrounding tissues seemed entirely free from demonstrable inflammatory change. It required the most painstaking dissection with the fingers to separate the appendix which was adherent about $1\frac{1}{4}$ inches from its tip over the sheath of the vessel. Once freed it was readily brought out through the incision enabling the work of completing the operation to be done outside of the abdomen.

The gross appearance of the tumor is as follows. It was $1\frac{1}{8}$ inches in length, beginning $\frac{1}{4}$ of an inch from the tip and extending toward the proximal end for a distance of $1\frac{1}{8}$ inches, pyriform shape and $4\frac{1}{8}$ inches in circumference, fibrously hard, giving to the sense of touch a distinctly fibrous feeling. The surface was smooth, and save for the site of adhesion to the vessel, was free from roughness. The various layers of structure composing the growth were firmly adherent one to the other down to the mucosa, this latter was in no way connected, though it had undergone an independent thickening so extensively as to stand out like a quill and almost as firm, the neoplasm could be withdrawn and replaced over it with the same ease that the piston of a syringe can be moved backward and forward within its barrel.

The proximal end of the appendix for about $\frac{1}{4}$ of an inch was in appearance entirely free from involvement and with the exception of the adherent surface the entire organ was smooth with a grayish-white or ground-glass color. The stump was ligated and pushed into the colon. The serous coat was sutured, and the abdominal incision closed. The recovery was uneventful. The patient left the hospital on the fifteenth day. A visit from him two weeks ago showed improvement both in body weight gain, and general nutrition.

Anatomic Diagnosis—Chronic interstitial appendicitis

Pathologic Diagnosis—Infiltration carcinoma

REFERENCES

- Weber, St Petersburg, Med Wochenschrift, 1907
Zaayer, B S 54 H2 Beitrager Fur Klin, Chirurgie
Merlin, 1838
Prien, 1865
Rokitansky, 1867
A W Elting, New York Med Society, 1903
Thorndike, Boston City Hospital
Craig Barrow, Savannah, Ga
W H Battle, London
Dr Howard Kelly, The Vermiform Appendix and Its Diseases
Monks, Boston City Hospital, J H H Surgery, No 9037
Sergent, London, Endothelioma of the Vermiform Appendix

HERNIA OF THE APPENDIX, COMPLICATED WITH APPENDICITIS.*

BY DAVID WALKER BASHAM, M D,
OF WICHITA, KANSAS

NOTWITHSTANDING the subject of this communication is of but minor importance, the comparative infrequency of hernia of the processus vermiformis ought to justify the report of every case encountered

It may be argued from the practical standpoint that it is of no importance to the surgeon or the patient to know beforehand what is contained in the sac of a hernia, that the operation is the same no matter what the condition. This is to be granted if we allow that the office of the surgeon has no aim beyond the ability to do an operation and dispose of the ordinary complications to be dealt with. But, as the principles of medicine are being more and more crystalized into a science, diagnosis naturally assumes a higher place in the mind of the surgeon, besides the world has always expected us to understand things which we undertake

The diagnosis of hernia of the appendix will always be surrounded by difficulties, but bearing in mind that such a thing is possible and having a knowledge of the phenomena attending the condition, it will in most instances be possible to make a probable diagnosis

When the processus vermiformis is inflamed in the sac of a hernia the clinical picture is that of strangulated enterocele minus the obstruction that usually attends the latter. In differentiating hernia of the appendix with inflammation from strangulated enterocele, it is well to remember that in the former the symptomatic syndrome is that of an inflammatory condition while the phenomena of obstruction predominates in

* Read before the Western Surgical and Gynecological Association at St. Louis, Dec 31, 1907

the latter Levy lays stress upon pain felt about the umbilicus In my own case there was great pain in the right iliac region The form of the sac is alantoid, excepting when the appendix enters the canal doubled upon itself An epiplocele may have the same appearance but is usually not so distinctly fusiform The appendix in the hernial sac may be mistaken for an inflamed gland The percussion note in both omentocèle and hernia of the processus vermiformis is dull No age is exempt from hernia of the appendix vermiformis, but it has been observed far more frequently in the aged and more often in the male sex The appendix has been found more often in right inguinal than in cruial hernia This probably accounts for its greater frequency in the male sex It has been found in left-sided hernia The appendix may occupy the sac of congenital as well as that of acquired hernia

Levy has raised the question as to whether inflammation of the epityphlon is the result of incarceration or whether the incarceration is due to inflammation and consequent swelling of the organ He inclines to the belief that inflammation precedes incarceration

It is said that an attack of epityphilitis predisposes to hernia of the appendix The causes of appendicitis in the herniated organ are the same as the causes for inflammation in the organ *in situ naturalis* It must be remembered, however, that trauma is infinitely more frequent in the herniated than in the appendix in its normal situation As before stated, by far the greater number of cases of inflammation of the herniated appendix occur in aged patients Levy accounts for this on the hypothesis that rheumatism predisposes to the formation of calculi and that diminished peristalsis in the aged prevents the appendix from emptying itself as rapidly as in youthful patients This authority gives the causes of inflammation of the herniated appendix as traumatism, concretions, foreign bodies and digestive disturbances

Perityphlitis may give rise to a serous effusion into the sac Grave cases may be complicated with peritonitis or even

phlegmon Perforation is frequent According to Levy, one of the capital symptoms of appendicitis in the sac of a hernia is pain of a sticking and paroxysmal character always felt with greatest force in the same place Sometimes there is a radiating pain directed from the inner inguinal opening toward the abdominal cavity The tumor enlarges rapidly Sometimes there is crepitation The general manifestations are acceleration of the pulse and sometimes vomiting with elevation of the temperature In the gangrenous form the temperature may be low Levy makes the statement that vomiting is more frequent in simple incarceration of the appendix than in appendicitis Peritonitis beginning in the herniated appendix may rapidly become phlegmonous

In the differential diagnosis simple incarcerated hernia is first to be excluded In epityphilitis hernialis as contrasted with strangulated enterocele the inflammatory phenomena predominate Vomiting is less frequent and obstruction of the bowel is not often present, while the general appearance of the patient is not so grave The diagnosis is always beset with uncertainties Bichat observed the possibility of suppurative infection spreading from the epityphlon *in situ normalis* to the hernial sac and vice versa from the hernial sac to the general peritoneum Bichat reports a case of his own and cites another from Korte in support of this statement

Hydrocele may exist with hernia of the appendix and perforce with appendicitis hernialis The wearing of a truss over a herniated appendix is fraught with dangerous consequences Taxis is to be avoided under all circumstances

Levy observes that the operation is to be determined altogether by the condition in which the appendix is found upon opening the sac The appendix must be liberally exposed and resected if possible and the wound closed so as to cure the hernia In the presence of phlegmon or suppuration this cannot be done any more than we would close the abdomen after an operation for suppurative appendicitis In the presence of phlegmon or suppuration

in the hernial sac drainage must be employed. If an active phlegmon is encountered Levy counsels splitting the appendix and drainage until the sloughing and infection subside when the clean radical operation is done. Jonathan Hutchinson, Jr., who wrote upon this subject in the *British Medical Journal*, Oct 21, 1899, holds about the same opinion.

One of the latest studies of this subject is the thesis of Jacquemin at Paris, 1905. He does not confine his reports to cases of hernia of the appendix alone, but includes all cases of hernia in which the appendix is present. This authority looks upon strangulation of the appendix as being very rare, excepting where the organ has prolapsed into the canal doubled upon itself. He agrees with all other authorities regarding the influence of old age on hernia of the appendix, but admits that no age is exempt from the accident. He mentions the fact that a hernia with painful crises or one with an unusual history ought to be suspected as containing an appendix. He calls attention to Demoulin's two cases of hernia of the appendix complicated with sacculated cysts, giving to the case the aspect of hydrocele of the cord. He likens appendicitis herniaria to appendicitis in other unusual locations. The difficulty of diagnosis is increased because appendicitis in a hernia is not very different from what sometimes takes place in an ordinary hernia strangulated or inflamed. He regards the prognosis as good excepting in neglected cases. Jacquemin tabulates fifty-eight cases with six deaths, most of which were due to procrastination. He shows how the attendant may be misled by the insidiousness of the onset and the simulation of the disease to epiploitis.

John G. Sheldon published a paper on this subject with report of a case in *American Medicine*, 1903.

Bull and Coley observed the appendix in right inguinal hernia sixteen times in a thousand cases.

R. Peterson found the condition twice in ninety right hernias.

Hutchinson is responsible for the statement that an attack

of appendicitis predisposes to hernia of the appendix. He describes certain changes in the organ due to inflammation that facilitated its entrance into the inguinal canal. He states that a hernia containing an appendix is usually irreducible and tender on deep pressure. If the appendix is found in a normal condition at the operation he advises returning it to the abdominal cavity.

REPORT OF CASE—H. W., German farmer, living near Yates Center, Kas., he had been the subject of an inguinal hernia of the right side for several years. The hernia had often been painful. He had worn a truss. He was referred to me for operation by Dr. Maxon, of Toronto, Kas., August 17, 1907. He entered St. Francis Hospital the same day. According to the statement of the patient he had felt ill eight days before and had called a physician on the fifth day previous. This physician employed taxis persistently, and failing to reduce the hernia, told him to remain in bed and employ liniments. Three days later, feeling much worse, he summoned Dr. Maxon who recognized the condition and advised operation. The operation was done on the evening of the seventeenth day of August, the same day of admission to the hospital and the eighth day after the attack.

Inspection revealed a sausage-shaped mass in the right inguinal region extending from the external ring to the testes in the scrotum. Palpation showed the mass to be smooth, hard and tender on pressure. The tenderness extended to the right iliac fossa. The patient looked sick and was hiccupping slightly. The bowels were not obstructed. An incision was made over the tumor, the upper and outer limb of which corresponded to the Bassini incision for hernia, and the lower part was extended over the cord into the scrotum. Upon opening the sac a small quantity of foul-smelling fluid escaped. The appendix, enormously enlarged and discolored and adherent constituted the contents of the sac. The walls of the sac were very much thickened and adherent to the cord and the testicle. Upon dissecting up the appendix the head of the caecum and the ilio-caecal junction formed an infundibuliform projection into the upper part of the canal so that the entire processus vermiformis lay in the sac.

The caecum and ilium were adherent about the entrance to the canal. The appendix was resected close up to the caecum and the sac of the hernia dissected away. As much of the wound as possible was closed, as in the Bassini operation, but, deeming it absolutely necessary to employ drainage, a cigarette the size of the little finger was carried down to the stump of the appendix, thereby making the closure of this part of the wound defective. The drainage was removed entirely at the end of a week and the wound healed.

J. M. ELDER, in the *Montreal Medical Journal* of March, 1901, reports a case of appendicitis herniaria with perforation, in an infant seven months old, operated, with recovery.

BAILLET, of Orleans, France, *Revue de Chirurgie*, page 294, 1904, reports the case of an infant of thirteen months on which he operated for appendicitis herniaria with satisfactory result.

LEURET reports a case of appendicitis in the sac of a hernia in a child of three years.

BARTH, cited in *Jahresbericht*, 1902, page 811, reports the case of a woman of eighty years whom he operated upon for gangrenous appendicitis in the sac of a hernia eight days after the onset of the disease.

FRANKELS, *Jahresbericht*, 1902, page 811, reports a case of herniated processus vermiformis in which the organ contained a fish-bone penetrating the mucosa. Estienny, in the same volume and page, reports a case. Dutoit, on page 811, *Jahresbericht*, 1902, reports the case of a woman of fifty-two years with partial obstruction and gangrenous appendix, with rupture in the hernial sac.

SOULIGOUX, *Jahresbericht*, 1902, reports a case of appendicitis in congenital hernia with a knuckle of bowel.

RUTHERFORD reports a case of a woman of seventy-nine with appendicitis in a crural hernia.

GALTEN reports a case of appendicitis in the canal of a hernia.

KOLLIKER reports a case of a sixty-nine year old woman with appendicitis herniaria, *Jahresbericht*, 1902, page 807.

MOUCHET, *Jahresbericht*, 1901, page 623, reports a case where an old hernia manifested signs of strangulation which was found to be due to an inflamed appendix present in the sac.

GOEBEL, *Jahresbericht*, 1901, page 623, found a perforated appendix in the sac of an hernia.

STECCHI, *Supplemento Al Policlinico*, April 14, 1900, reports a case of appendicitis herniaria.

CALVINI, *Clinica Chirurgica*, 1902, No. 1, reports a case with operation and recovery.

COMINACINA, *Supplemento Al Policlinico*, 1902, No. 34, reports a case of appendicitis herniaria with peritonitis-operation and recovery.

WULFF, page 757, Jahresbericht, 1902, reports a case of appendicitis herniare Mires on the same page reports a case, while two cases are reported by Condamin Racovicieano reports the case of a man of sixty-five with suppurative orchitis with appendicitis in the hernial sac Quenu, Jahresbericht, 1905, page 599, reports the case of a woman of forty-two in which the appendix was strangulated in a hernia The portion of the appendix distal to the strangulation was in a state of inflammation operation and recovery Bichat reports a case cited on the same page with fatal termination I do not believe any of these cases were included in the 116 tabulated by Bajardi and Briancon

ENORMOUS ENDOTHELIOMATOUS CYST OF THE GREAT OMENTUM.

BY EDWIN M HASBROUCK, M D ,

OF WASHINGTON, D C ,

Assistant Surgeon to Georgetown University Hospital

TRUE cyst of the omentum is of exceedingly rare occurrence, in fact, an exhaustive search of the literature has brought to light but nineteen cases. The Index Catalogue and the Index Medicus in the library of the Surgeon General's office contain thirty-four reported cases, but these have to be very carefully sifted out in order to obtain the cases of what I term true cyst of the omentum,—*i e*, cyst of the omentum itself. Twelve of these on careful analysis prove to be cysts springing from the omentum, attached to it by a pedicle or otherwise connected with it.

True cyst of the omentum is a cyst *within the cavity of the omentum*, lies entirely within its folds, and is not external to it in any way. A cyst springing from the omentum by a pedicle or connected to it in such manner as to show that it is clearly of it, is undoubtedly an omental cyst, but of an entirely different type from that serving as the basis of this paper. In fact, up to the present time, no one seems to have separated the cysts occurring *within* the cavity of the great omentum into a class by themselves as distinct from those wholly or partially *external* to the omental pouch. That this distinction should be made seems imperative, as the etiology of the one can be very distinct from the etiology of the other, as witness that of my case in which an omental endothelioma within the omental pouch was the beginning, and one of the external type in which an escaped ovarian cyst that had attached itself to the external border of the omentum is supposed to be the origin.

True omental cysts therefore are of sufficient rarity to

merit attention whenever found Fort (ANNALS OF SURGERY, 1907) reports a case which he considers to be the twenty-third on record, but according to my researches he has evidently admitted four cases not entitled to be classed as of this type, and his is really the nineteenth, the case I shall report making the twentieth

The condition was called to the attention of the medical profession in 1851 by Gairdner, who reported the first case, but advanced nothing to show the etiology Later, in 1885, Doran¹ asserted that dermoid cysts of the omentum were really ovarian cysts that had become separated from their pedicles, and mentions the case of a small, soft, white body found adherent to the posterior aspect of the omentum with a pedicle about four inches long which proved to be the left Fallopian tube, the soft white body being the ovary He thinks the ovary had become displaced, the stretched tube and ligament would in such a case be bound to atrophy and the tumor get its blood supply from the omentum He admits that this could not always be the case, as dermoid abdominal tumors have been met with in males for which he advances no explanation Jacobi,² writing of omental tumors as a class, says "Nearly all of them, perhaps all, are of lymphatic origin, and result either from dilatation of lymph veins or from a cystic degeneration of lymph-nodes" Rokitsky³ describes such Weichselbaum⁴ reports a case of the first variety and Sabourin & Le Dentu⁵ another that contained chyle A case of the second variety is reported by Werth⁶ and by Duearkler⁷ Werth's case was a cyst as large as a child's head, rising from a segment of the mesentery of the small intestine (singularly enough, much difficulty was met with at times in telling whether the author meant cyst of the *mesentery* or of the *omentum*) There were no formed elements Rokitsky explains it as a cystic degeneration of lymph-node caused by a primary obliteration of vasa efferentia, while the entrance of chyle not being impeded must lead to retention and dilatation A similar cyst has been described by Eppinger,⁸ who erroneously supposed it to be a dermoid, three of which have been

reported, one each by Waldy⁹ and by Lipscher¹⁰—both external to but attached to the omentum, while Bonfigli¹¹ reports one contained within the cavity of the omentum itself

The accompanying abstracts give a brief outline of each case of true omental cyst, while Table I, arranged in chronological order, is open to considerable analysis (fractional percentage not given)

ABSTRACTS IN BRIEF OF REPORTED CASES

CASE 1—GAIRDNER The cyst was found beneath the anterior layer of the great omentum in a woman dying unexpectedly, having a large fibroid uterus. It consisted of a large closed sac, and contained a transparent, colorless serum.

CASE 2—SIMON Male, 44 years of age. Tumor could be felt in the right hypogastric region simulating a distended bladder. This tumor dated twelve years back but had never been painful. Catheterization brought only a little urine, and the catheter could be felt impinging against a resistant mass. Death five days after admission. Autopsy showed a tumor in the folds of the great omentum extending from the stomach to the upper part of the pelvis. It had a distinct thick-walled capsule, and contained much coagulated blood. It could be traced to no abdominal organ.

CASE 3—JONES Male, aged 58, farmer. Had always enjoyed excellent health. First complained two years previously of pain in the back and frequent micturition, with a feeling of weight and oppression in the bladder. He was relieved of these and not seen again for a year. Distressing nausea and vomiting with other dyspeptic symptoms were now complained of, together with renewal of the old symptoms. A small tumor was made out in the left hypogastric region which grew rapidly, and the man died. Autopsy. An enormously enlarged abdomen from ensiform cartilage to pubes, adhesions everywhere. A large cyst was found evidently originating in the omentum. It contained a broken-down sarcomatous mass weighing 15 pounds, also about 3 gallons of fluid. Lymphatic glands not enlarged. Tumor was an alveolar sarcoma.

CASE 4—DORAN Patient was a woman aged 58. Had suffered for many years from symptoms resembling cystic ovarian disease. Two years previously cyst had ruptured and filled again, had been tapped several times. Large cyst was found at operation intimately adherent to the parietal peritoneum near the umbilicus, and was entirely within the omentum. Recovery.

CASE 5—GOODING Girl, aged 19. When 18 years old she first noticed a lump the size of a hen's egg low down in right iliac fossa, which was painful chiefly at menstruation. It grew in size gradually upward. At time of observation it was as big as a cocoanut and reached

ENDOTHELIOMA OF OMENTUM

TABLE

	Date	Reporter	Sex	Age	Treatment	Result	Reference
1	1852	Gardner, W T	Female	Adult	None	Death	Tr Path Soc, Lond, (1850-51) 1852, III, 374
2	1858	Simon, E	Male	44	None	Death	Bull Soc Anat d Paris, 1858, vvviii, 30
3	1881	Jones, Talbot	Male	58	None	Death	Med Rec, N Y, 1881, xiv, 600
4	1882	Doran, Alban	Female	58	Removed	Recovery	Trans Obst Soc, Lond, 1882, xviii, 164
5	1887	Gooding, J C	Female	19	Removed	Recovery	Lancet, Lond, 1887, 1, 311
6	1890	Wells, Spencer	Female	4	Removed	Recovery	Brit M J, 1890, 1, 1362
7	1893	Cazin, M	Male	48	Removed	Recovery	Bull Soc Anat d Paris, 1893, lviiii, 312
8	1896	Erdheim, S	Female	22	Removed	Recovery	Wein klin Rundschau, 1896, x, 131
9	1896	Marfan, A B	Female	2½	Removed	Recovery	Press Med, Paris, 1896, 133
10	1896	Jessett, F B	Female	Adult	Removed	Recovery	Brit Gynaec Jour, 1896-7, xli, 156
11	1897	Hearn, W J	Male	8	Removed	Recovery	ANNALS OF SURGERY, 1897, xxv, 1, 703
12	1898	Braithwaite, J	Female	4	Removed	Recovery	Lancet, Lond, 1898, II, 1472
13	1901	Jacobi, A	Female	7	Removed	Recovery	Trans Ass Am Phys, 1901, vvi, 232
14	1901	Marsh & Monsarratt	Female	1 yr 8 mo	Removed	Recovery	Brit M J, Lond, 1901, 1, 511
15	1902	Catman, H H	Male	21	Removed	Death	Brit M J, Lond, 1902, 1, 1267
16	1903	Schamm, H	Female	1	Removed	Recovery	Zentralb f Chr, 1903, xxx, 564
17	1903	Boyd, S	Male	11	Removed	Recovery	Clin Jour, Lond, 1903, xxi, 306
18	1905	Young, W McG	Female	9½	Removed	Recovery	Lancet, Lond, 1905, 1, 157
19	1907	Fort, R E	Female	2½	Removed	Recovery	ANNALS OF SURGERY, 1907, xlv, III, 382

to the umbilicus Diagnosed as ovarian cyst with a long pedicle At the end of two years she began to suffer with occasional vomiting after meals, and considerable shooting pains in and about the tumor, and tumor had enlarged very much Operation disclosed a cyst densely adherent to parietal peritoneum, and embedded in the folds of the omentum, there was no pedicle Some months previous to discovering the lump she had received a severe blow in the stomach Recovery

CASE 6—SPENCER WELIS Female, aged 4 Had large abdomen since early infancy that has increased in the last year Diagnosed ovarian cyst Operation showed a thin-walled cyst of omentum in the right iliac fossa, adherent to abdominal wall, cæcum and appendix Recovery

CASE 7—CAZIN Male, aged 48 First noticed the tumor the previous year which had developed without any history of trauma, and had gradually enlarged Had been tapped several times, and $7\frac{1}{2}$ liters of a bloody fluid withdrawn Diagnosed as cyst of pancreas Operation showed it to be a cyst of the great omentum, and adherent to large intestine Recovery

CASE 8—ERDHEIM Female, aged 22 Five years previously the tumor had appeared without cause, and had reached its present growth in fourteen days according to patient's account (this is questioned) No traumatic history obtainable, but has often done heavy lifting Diagnosis Ovarian cyst Operation disclosed a bluish, transparent cyst wall adherent over a wide area, and covered with omentum Cyst required opening and evacuating before it could be removed There was no connection with any of the pelvic organs Tumor reached from transverse colon to the bladder Recovery

CASE 9—MARFAN Female, $2\frac{1}{2}$ years Family history negative Mother had noticed that abdomen had always been large, and at the age of 15 months it began to increase in size, and has been steadily enlarging for a year No disturbance has been manifested in the physical condition until toward the last few weeks, when emaciation set in Aspiration brought a blackish, hemorrhagic liquid—about two liters altogether This had gradually reaccumulated Operation revealed a cyst containing a large quantity of fluid It was a multilocular cyst within the folds of the great omentum and had a pedicle Recovery

CASE 10—JESSETT Female, adult Case was diagnosed as ovarian cyst Operation showed a cyst within the folds of the omentum and adherent to upper part It contained a quantity of cholesterol Recovery

CASE 11—HEARN Male, aged 8 At birth his physicians noted that the abdomen was markedly distended This disappeared at six weeks and was not particularly noticeable again until 6 years old, when the abdomen again began to distend In the meantime he enjoyed good health Of late, abdomen has increased rapidly in size, the chief difficulties being weight, dyspnea and frequent micturition The abdomen was enormous, measuring 44 inches in circumference An omental cyst was suspected, owing to lack of symptoms of other troubles Operation discovered a cyst containing a dark greenish fluid and many other cysts After evacuating a number the mass was drawn out and found to be attached to the

great omentum between the folds of which it had developed, it weighed about 50 pounds Recovery

CASE 12—BRAITHWAITE Female, aged 4 Measured $22\frac{3}{4}$ inches at level of umbilicus, this had increased during two months Tumor was found to be entirely within the folds of the great omentum and with the exception of adhesions to the intestine was easily removed It contained $3\frac{1}{2}$ pints of fluid Recovery

CASE 13—JACOB Female, aged 7 Four years previous to seeing patient abdomen began to swell and the child lost flesh A diagnosis of tubercular ascites was made and two quarts of a clear, slightly bloody serum was drawn off After two years the swelling was again in evidence and was tapped a second time Operation disclosed a very thin-walled cyst, multilocular, containing about two quarts of fluid It was incorporated in and involved the greater part of the great omentum, it narrowed into two pedicles as it approached the stomach Recovery

CASE 14—MARSH and MONSARRATT Female, aged 1 year, 8 months Abdomen was noticed to be enlarged about four months previously, but there was no complaint of pain Abdomen measured $23\frac{1}{2}$ inches just above navel Was tapped four times Operation showed a thin-walled, multilocular cyst springing from omentum of greater curvature of the stomach, and entirely enveloped in omentum It contained about ten pints Recovery

CASE 15—CATMAN Male, age 21 Three months previously had received a severe blow in the abdomen from the shaft of a cart while riding a bicycle Accident kept him from work for five weeks Since then has complained of a lump in his stomach Operation disclosed a tumor connecting with an opening into the stomach Tumor was a blood-cyst between the layers of great omentum Death

CASE 16—SCHRAMM Female, aged 1 year Enlargement of abdomen had been observed four months previously, was growing larger Abdomen measured 91 cm in circumference at umbilicus Tumor mass could be easily outlined Diagnosis Tubercular peritonitis, with fluctuating exudate Operation disclosed a cyst occupying entire omentum, more a conglomerate mass of cysts It was removed entire Recovery

CASE 17—BOYD Male, aged 11 Family history negative Always felt well until January of the present year (1903) His trouble began with vomiting, loss of appetite, and inability to run about because he felt so tired His abdomen began to swell at this time and has increased steadily in size Has had constant pain in lower abdomen, but never of a severe nature, and has lost much flesh Diagnosed as tubercular peritonitis, also cyst of the left kidney Operation disclosed a large thin-walled cyst covered by and occupying the cavity of the great omentum Twelve pints of greenish-brown fluid removed Was attached to the pancreas, but did not appear to spring from it Recovery

CASE 18—YOUNG Female, aged $9\frac{1}{2}$ Body had always been full from infancy, and was enormously distended from beneath the costal arch—which was bulged—to the symphysis At operation a thin-walled cyst was found containing other cysts It involved the anterior layers

of great omentum, and was adherent to the stomach, 32 pints of fluid were removed Recovery

CASE 19—FORT Female, aged 2½ years Had had two attacks of acute indigestion, each lasting several days Abdominal enlargement was noticed by the mother eighteen months previously Child measured 28 inches at level of umbilicus There were no symptoms other than dyspnea Operation revealed a dark glistening tumor within the folds of the great omentum Recovery

THE FOLLOWING CASES HAVE BEEN REPORTED AS OMENTAL CYSTS, AND WHILE SUCH, DO NOT COME WITHIN THE MEANING IN THE SCOPE OF THIS PAPER.

1 GAY (Ext f record of Bost Soc f Med Imp, 1859, III, 248) Female, age 46 Is not at all certain what he found, but in addition to opening the abdomen and evacuating a large amount of fluid, he drew up into the wound a number of tumors firmly connected with omentum, of a firm "scirrhus" hardness, and firmly fixed in the omentum He feared to remove them Recovery

2 THORNTON (Brit M J, 1882, II, 1243) Adult, female A small multilocular cyst the size of a cherry was removed during ovariectomy It was attached to the lower border of the great omentum by a small pedicle He thinks it was an ovarian cyst owing its origin to cell infection

3 THORNTON (Brit M J, 1882, II, 1243) Female, 47 years old Tumor the size of a cocoanut with a thick sac attached by thick pedicle to the omentum It lay under the right border of the liver, it was a mixed sarcomatous cyst Recovery

4 ORMSBY (Med Press & Circular, Lond, 1883, xxxv, 258) Female, aged 26 Had had large abdominal tumor for six years, and measured 54 inches at the umbilicus Operation disclosed a multilocular tumor containing fluid so thick it would not run through the trocar It sprung from the great omentum

5 EDEBOHLS (New York Jour, Gynæc & Obst, 1893, III, 614) Female, aged 37 Had noticed symptoms of enlargement for eight months previously Tumor had a distinct cyst wall which was gangrenous over a considerable area It was a mono-cyst, and contained a chocolate-colored fluid It had no connection with any structure, excepting the omentum to the lower border of which it was attached by a firm pedicle

6 KEEN (ANNALS OF SURGERY, 1898, xxvii, 220) Male, age 48 About fifteen months before had noticed a lump a little larger than an egg in the lower right segment of the abdomen, which gradually increased in size, of late rather rapidly, and finally filling the abdomen and causing much respiratory trouble and frequency in urination Had never caused any great pain Had no gastric or intestinal symptoms, excepting from compression of the bowels Had lost 30 pounds in weight Trochar at operation brought about 3 pints of dark, bloody fluid On the right side the tumor was free from adhesions, excepting to the omentum, but on the left side it was intricately adherent to the omentum and the stomach was spread out fan-shaped over its entire surface It was a mixed-celled sarcomatous cyst. The danger of tapping such a cyst was well

illustrated, as had it been tapped in the upper part the stomach would have been perforated, being spread out over it

7 ROSE. (King's College Hosp Rep, (1896-7), 1898, iv, 101) Adult, female Had been operated upon for a multilocular ovarian cyst About a fortnight after the operation she complained of pain in the right loin Examination disclosed a tumor occupying the right lumbar region and extending up under the costal arch Diagnosed as a renal tumor At operation a multilocular cyst was found connected to the omentum by narrow adhesions Recovery Rose thinks it originated in the right ovary and became detached through twisting of the pedicle

8 MAUCLAIRE and DESARNAUX (Bull d Mem Soc de Anat, Paris, 1902, lxxvii, 683) Female, aged 52 First began to complain five months previously and was treated for gastric troubles, complicated with the uterus There was some emaciation, obstinate constipation, and a prominence in the subumbilical region the size of an adult's head A provisional diagnosis was made of cancer of the head of the pancreas, also of a cystic tumor Operation, with death six hours later Autopsy showed a probable cancer of head of pancreas, with hemorrhage into the omentum from a pancreatic vessel

9 SCHWARTZ (Gaz de Osp, 1902, xliii, 764) Female, age 43 Family history negative Never remembers having been ill, has had several abortions and was forced to take to bed because of pains in left side Present trouble dates back eight months, when there was sharp epigastric pain and vomiting, and she noticed abdomen beginning to enlarge Her physician found a tumor in the epigastric region This was aspirated twice, getting some fluid Tumor extended from ensiform cartilage to near umbilicus Diagnosis Either echinococcus cyst of liver or independent of it, or might be a cyst of pancreas, or from stomach and transverse colon Operation showed cyst completely adherent to lesser curvature of stomach Cyst wall was stitched to abdominal wall and aspirated two days later and as much of cyst wall cut off as possible Recovery

10 LANCE and LECENE (Bull de Mem Soc de Anat, Paris, 1903, lxxviii, 400) Female, aged 60 Had noticed presence of tumor for four years, which had gradually increased to large size, until abdomen was the size of the uterus at full term Diagnosis Multilocular ovarian cyst Operation revealed seven cysts containing yellowish fluid and some blood Mass was easily removed It was free in abdomen and had only two slight adhesions It contained ten liters of liquid, and had a distinct capsule Recovery

11 MATTHEWS (Brit M J, Lond, 1905, 1642) Male, aged 8 Following attack of measles nine months previously he complained of pain in left side There was gradual distention of the abdomen Greatest circumference measured 27 inches There was no history of any previous illness or trauma The tumor consisted of a large sac and contained 6 pints of dark-brown fluid It was attached by a thick pedicle of omentum to transverse colon

12 BIDWELL (Brit M J, Lond, 1905, ii, 806) Male, aged 62

Had always been stout, but recently his abdomen had begun to enlarge and was enormously distended. It was tapped, and 4 gallons of blood-stained fluid withdrawn. Afterwards a hard mass could be felt, and was diagnosed altogether five times. Diagnosis: Malignant disease of the omentum. Operation disclosed a cystic tumor that sprung from the omentum by a distinct pedicle. It contained a growth which was not examined. Recovery.

Of the nineteen patients, nine were adults—47 per cent, while ten were below ten—52 per cent. (One of eleven years is included for convenience.) This is too nearly an even division to lend much weight to the theory of congenital origin. As a matter of fact seven cases only—36 per cent, those of Wells, Hearn, Marfan, Marsh & Monsarratt, Young, Schramm and Fort are clearly congenital by their histories, while those cases occurring in adults (47 per cent) were probably not congenital at all. It would seem, therefore, quite likely that while some cases are undoubtedly congenital, others may be acquired in later years through traumatism or other causes, just as we have hernia, hydrocele and many other affections both congenital and acquired. Certain it is that six, cases 2, 3, 5, 7, 8, 15, specifically state or intimate that they felt perfectly well up to the time of discovering the tumor, while three, cases 5, 8(?) and 21 are traceable to trauma—(my own making four).

One very striking thing shown is the great frequency of occurrence in females, 13 cases—79 per cent, as against six in males—31 per cent. This same preponderance being found also in the external variety of omental cysts. It has been suggested that some of these have originally been ovarian cysts that have become separated from their pedicles and attached to the omentum. This is not at all unlikely in cases occurring in females and in those of the external variety, but can certainly not be said of those found in males.

The operative results have been especially brilliant. Sixteen cases were operated upon with one death, a mortality of 6 per cent, the oldest case being 58 years, the youngest 1 year of age.

The histological characteristics and the contents of these cysts are of such a wide variety that it is hard to suggest a

distinct etiological factor Lymph, chyle, serum and blood have all been reported. my own contained an enormous blood clot, and thirteen of the nineteen cases mention a distinct capsule or the record is so worded as to leave little room for doubt of its existence

My own theory regarding the etiology of my case and all similar cases where a growth is involved, is, that there was first the endothelioma of the omentum, by inflammatory action the two surfaces of the omentum became fused together, forming a closed sac within which grew the endothelial cyst The blood clot contents of course being derived from repeated hemorrhages from the parent tumor

My case is as follows

Ada D, colored, married, age 50 About one year ago she noticed a swelling in the lower abdomen which gradually increased in size until the abdomen became enormous, the distension extending up under the costal arches causing them to bulge, and interfering very materially with respiration Constipation was also a marked feature So far as she knew nothing had ever happened to her as a possible cause other than repeated blows in the abdomen, given by a small child butting its head into her while running at full speed as a pastime At times the tumor pained some, but not to any great extent, and she had always enjoyed good health up to the appearance of the tumor Her principal trouble was from the great weight, difficult breathing, frequent micturition and constipation from pressure Examination showed the abdomen enormous in size and distended apparently almost to bursting In the prone position the swelling began from behind the ensiform cartilage and costal arches, breathing impaired Tumor fluctuating Vaginal examination negative Diagnosis multilocular ovarian cyst

Operation —Incision through right rectus Abdominal wall very thin, not over one-quarter inch, including all layers Immediately on opening the peritoneum the tumor presented itself, dark bluish-black in color A trocar plunged into it brought away about half a pint of grumous fluid There was also a small quantity of ascitic fluid external to the tumor The tumor was semi-solid and occupied the entire abdominal cavity except the deep pelvis No connection whatever with uterus, ovaries or

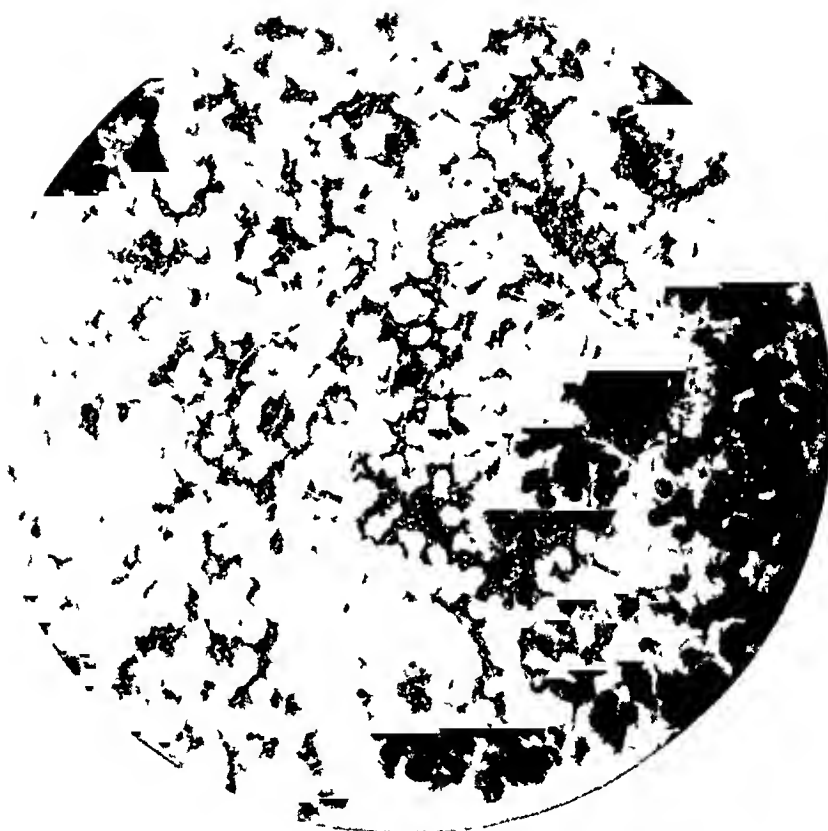
tubes, and the entire mass was completely enveloped within the cavity of the great omentum, and lay anterior to the intestines. Veins of the omentum enormously distended, many as large as a lead pencil, formed a network or mesh completely enveloping the tumor mass, and very little of the omentum itself remained,—only the network of veins,—most of it evidently having been absorbed by pressure. The transverse colon was pushed down almost to the symphysis pubis. There were very few adhesions, and these were mostly quite flimsy and easily broken down. There was one very firm fibrous band attached to the abdominal wall anteriorly, and another tough one almost like a pedicle, to the stomach, causing a suspicion that the tumor sprang from an old gastric ulcer, but there was nothing in the history to warrant such a finding, and later this was found to be only a dense adhesion. The wall of the stomach was slightly torn in the external coats in separating this adhesion and was whipped over with catgut. There were also some dense adhesions to the mesocolon and of course everywhere to the omentum. In fact very little of this structure was saved, being ligated in bunches and divided in order to turn out the tumor, which, owing to its large size and solid contents was impossible. Accordingly the sac which was very thick and tough was opened disclosing a number of smaller cysts inside, and enormous quantities of blood clot, many handfuls of which were removed before it was possible to pull the tumor through the incision. There was no pedicle.

After removal of the tumor the liver was found much atrophied from long-continued pressure, pale and anemic, and containing several small retention cysts which were punctured. Many bleeding points required ligation where omental adhesions had been ruptured, and a rent in the mesocolon was sutured. Salt solution was given under the breasts and about a quart sewed up in the abdominal cavity. Morphine-hyoscine-strychnine anesthesia was used supplemented with a few whiffs of chloroform.

The patient reacted well from the operation, there was no shock, and she made an uninterrupted recovery.

The specimen as removed weighed eight pounds,—which was simply the sac and parent tumor, it did not include any of the blood clot. Before opening, the tumor probably weighed not far from forty pounds. It sprang from the omentum between the stomach and transverse colon.

FIG 1



Section from author's specimen $\times 225$

PATHOLOGICAL REPORT, BY DR JOHN S HEATE

With reference to the tumor of omentum case of Dr Hasbrouck, microscopical examination shows it to be an endothelioma, or according to the more modern classification a mesothelioma

The cells comprising the tumor are in general epithelial-like in structure, some having considerable protoplasm and in shape polygonal, round, cuboidal or fusiform, according to location and pressure. They also show a disposition to arrangement in columns encircling the blood vessels, from which they appear to have their origin. The fibrous stroma is very vascular, resembling some forms of angio-sarcomas which, taken with the intimate relation between the cells and stroma, places it with the connective tissue type of tumors, and this type of cells, their arrangement and the organ involved makes it most probably an endothelioma (Fig 1)

My case appears to be unique in two particulars 1 Its character, originating from an endothelioma of the omentum 2 The contents, an enormous blood clot (Case 2, Table I, might possibly come under this variety)

Symptomatology and Diagnosis—Very little is to be gained from the symptoms leading to the diagnosis of the disease. In some cases there is pain of more or less intensity, but usually not very severe. Gastric disturbance—nausea, vomiting and anorexia are often present, but not in all cases, weight and dyspnoea are complained of, and bladder symptoms and constipation from pressure. Emaciation occurs after much enlargement has taken place. In my own case there was nothing whatever to point to a diagnosis. From all of which it would appear that there are no specially characteristic symptoms,—the condition merely simulating the other forms of cystic growth of the abdomen.

It is not strange therefore that one fails to make an exact diagnosis, as the condition simulates such a wide variety of disorders. In fact, almost everything else has been diagnosed, lipoma, ascites, ovarian cyst, aortic aneurysm, hydatid cyst of the liver, cyst of urachus, cyst of mesentery, pancreatic cyst, and encysted and tubercular peritonitis have all been named. It is doubtful if the diagnosis can be accurately determined from the limited amount of data usually at hand and the extremely rare occurrence of cases and the condition is

much more apt to be discovered at operation than determined beforehand

ADDITIONAL BIBLIOGRAPHY

- 1 Medico Chir Trans, 1885, lxxviii, 235
- 2 Trans Ass Am Phys, 1901, xvi, 232
- 3 Lehrbuch der Anatomie, p 677
- 4 Virchow's Archiv, xiv
- 5 Bull de la Soc d' Anatomie, 1876, 339
- 6 Archiv f Gynæk, 1880
- 7 Bull de l' Academ de Med, 1880
- 8 Prager Vierteljahrschrift, 1873
- 9 Lancet, Lond, 1889, ii, 642
- 10 Orvosí hetil, Budapest, 1901, xlv, 260
- 11 Riv Clin d Bologna, 1875, 2d s, v, 62

THE INCONSISTENCIES OF THE GAUZE PACK.*

BY HUBERT ASHLEY ROYSTER, M D,

OF RALEIGH, N C,

Professor of Gynecology in the Medical Department, University of North Carolina,
Surgeon-in Chief, St Agnes' Hospital

MORE and more each year, since I began the practice of surgery, there has grown in my mind a conviction that there are certain marked inconsistencies connected with the use of gauze, as ordinarily employed in our work. Let me say at the outset that I do not wish to be understood as condemning gauze packing in general. I am inclined, however, to doubt whether the introduction of gauze into surgical practice was as much of a blessing as it at one time appeared that it would be. Outside of its service as a dressing and sponge material, to which no legitimate objection can be offered, gauze is employed in surgery for first, draining recent or granulating wounds, and packing sinuses, cavities, *et cetera* and second, walling off septic matter while performing abdominal operations.

I. Methods of drainage were in general use before the principles of drainage were well understood. We drained before we knew why we drained. In the search for an ideal drain numerous materials have been employed. A strip of gauze was simply the means of applying to a wound the law of capillary attraction. Since it is a common experience that gauze frequently fails to drain, tubes of rubber or of other material have long been in use, while more recently combinations of rubber and gauze (split-tube and cigarette drains) are being substituted. The call for improvement in the manner of draining has come, because the object for which the gauze is employed is so seldom obtained. Instead of facilitating the removal of wound products, gauze, in fact, acts as a successful stopper to the outlet of the wound and impedes the natural outflow from it.

* Read before the Southern Surgical and Gynecological Assoc., New Orleans, Dec 18, 1907

The one thing to be desired in all drainage is the patency of the wound orifice, in order that the objectionable contents may escape. Whatever prevents this escape, either by clogging the cavity or by obstructing the opening, must be undesirable. Herein lies the chief indictment against the gauze drain, for both offences can be laid at its door. Not all the trouble, however, is due to the gauze, much of the mischief is done by the surgeon. As usually employed there could be no more efficient plug than the stereotyped gauze packing that is placed in a wound. Purulent discharges are not drained, but the gauze becomes soaked with them. The wound drains better when the packing is removed. In the instances in which the gauze pack is applied to arrest hæmorrhage, the end to be attained is just the opposite of drainage and the gauze should be put in as tightly as possible. To express it tersely, when intended for a drain, gauze should be inserted after the manner of a lamp-wick, when used for hæmorrhage, it should be packed in like wadding with a ram-rod.

The edges of a wound from which an unprotected tightly-fitting gauze tape is protruding begin to contract around it and become adherent to it in a few hours. Unless the secretion be of a very thin consistence no capillarity will be present and for this reason discharges which would easily be evacuated are held in by the very means employed for their removal. In shorter terms, a tight drain is worse than none.

To those who have seen the light and who are now using rubber tissue or tubes (and often no drainage at all where formerly they thought it indispensable), this arraignment of gauze may seem superfluous, but I am convinced that many surgeons do not yet appreciate the plain principles here involved. There is a field for the use of gauze in packing sinuses, fistulæ and granulating wounds, so that healing may take place slowly from the bottom. Even here, however, the packing should be loosely done and the gauze preferably saturated with some substance which will prevent sealing of the wound edges. But it is as a drain that the disadvantages of gauze constantly force themselves upon us. While some of us are probably not drain-

ing any more or less frequently, we are draining more judiciously and with clearer conceptions of why we drain. An eminent American surgeon said recently as he left a large wound open and packed it with gauze: "If I drain, this patient is sure to get well, if I close up, he may possibly die—therefore, I drain." Now, as far as my knowledge goes, I am not sure that I ever saved or lost a patient because I did or did not use a gauze drain. Apparently the matter is not always susceptible of proof on either side. Some will persist in the use of gauze drains and, in the event of disaster, console themselves by believing that it is better to have drained and lost than never to have drained at all. There are drains that do not drain and those who get good results with them are merely proving that no drainage was needed.

There is no controversy as to the object in view in the treatment of open wounds. If the surgeon be sure that the wound, unaided, will free itself satisfactorily from all deleterious fluids, he will insert no drain—and it is well. If, on the other hand, the surgeon be sure that the wound needs assistance, he will resort to artificial drainage—and it is well. Success follows both modes of treatment, and to some it may seem that it makes no difference whether we drain or do not drain, but surely to none can it seem a matter of indifference to employ or not to employ, for the purpose of drainage, a material like gauze tightly packed into a wound. It would appear, further, that all must recognize the importance of settling definitely the question whether a strip of gauze inserted loosely as a wick will continue to drain efficiently after it becomes saturated with pus or whether it will then cease to drain, thereby necessarily interfering with the natural discharge of fluids from the wound.

2 When we come to consider the use of gauze to wall off septic matter while operating within the abdomen, we approach a question which vitally concerns the work of every surgeon. I realize that I shall call attention to some matters not heretofore discussed and say some things which may be productive of much argument, and perhaps refutation of my opinions. My

criticisms of the method in vogue are derived entirely from observation of the work of others. For my part I have never fallen into the routine way of packing off with gauze in the abdominal cavity. There always seemed to me some well-founded objections to it and, as my mortality did not seem to be effected by omitting it, I continued to do without it. But, I believe that the majority of operators are in the habit of placing large pads or even huge rolls of gauze in the abdomen after making the incision in pus cases or suspected ones. This is done in order that there may be a protecting wall around the purulent area to ward off infection from the clean portions. To accomplish this end there must be a long incision, the viscera are subjected to unnecessary manipulation, and very likely the uninfected regions will be constantly in contact with pus-soaked gauze. Capillarity exerts its influence also, here as elsewhere, and, when one end of a gauze pad is in contact with purulent discharge, the whole piece will become soaked and the other end soiled, if sufficient time is allowed.

A glance at the accepted plan of introducing gauze for walling off will indicate its inconsistencies and even its dangers. At least, it may not be difficult to show its uselessness. When a free suppuration is present in the abdomen, the septic material will generally be seen at the incision, as soon as the cavity is opened, and, if an attempt is made to pack it off with gauze (though all the pus possible be first sponged away), the only sure thing done is the carrying of infectious products by means of the gauze to distant clean areas, there to remain during the operation as an added source of danger. In the case of an abscess already localized by nature, if the gauze might seem to be of use, it is when the shielding wall is, for some reason, intentionally broken through, but here it is open to the same objections as have just been mentioned. The truth is, exposure of peritoneum to gauze saturated with pus is just as pregnant with danger as the presence of pus itself among the intestines. Besides, the gauze pack, as a foreign body, interferes with the normal resisting power of the peritoneum. The superior tolerance of this membrane for infection and traumat-

ism explains why the mortality in abdominal surgery is not greater, particularly when the pack is used. Certainly every opportunity is afforded to extend infection by pushing rolls of gauze through collections of pus into healthy parts or by packing around abscesses with an artificial wall of gauze which becomes steeped in septic matter. And, finally, a glaring inconsistency is seen in the removal of the packs with already contaminated hands and in the unavoidable rolling upward of intestinal coils against the purulent area.

Perhaps some one will say that these observations may appear to be just, but that the conditions as described do not exist. That may be true of individual surgeons, but is it not probable that these things are being done over and over without a thought as to whether they are necessary or harmful? And is it not evident that many of those, who believe they are walling off, are not doing it? Some one again may ask if these objections against the gauze pack are to be sustained, what method shall we employ? It is not the purpose of this paper to provide ways and means. It might be suggested, however, that the gentle art of sponging will take care of the visible pus and that what lurks behind had better stay where it is and be permitted to escape later than to be carried to parts we know not of.

PREVESICAL ABSCESS.*

BY EUGENE H EISING, M D,

OF NEW YORK

Adjunct Surgeon, Lebanon Hospital, Assistant Adjunct Surgeon, Mount Sinai Hospital

THE clinical interest of the space of Retzius exists in suppurative disease of that space. A condition first described by Wenzel Gruber in 1862, since then cases have from time to time been reported, appearing chiefly in the French and German literature.

In 1856 the Swedish anatomist Retzius presented to the Academy of Stockholm the first detailed description of this space, indicating at the same time the surgical importance of that region. As described by Retzius the space does not conform with the findings of more recent observers, and not until the publication of Leusser's studies in 1885 have the anatomical relations of this space been defined. Subsequent collaborators, chief among whom are Pinner, Panzat, Delbet and Waldeyer have in the main corroborated his findings.

The prevesical space is one peculiarly designed for its special function. Its contents are a mass of loosely reticulated connective tissue enclosing masses of soft fat, there are few blood vessels and some lymphatic glands. The boundaries of this space are in part fixed and in part flexible, which together with its soft contents, permits of the distensibility of the bladder. The surgical features of this region are dependent upon the arrangement of the fasciae contributing to its formation.

According to Waldeyer, the posterior rectus sheath terminates several inches above the symphysis, forming the semilunar fold of Douglas. Beneath this level the recti muscles on either side are covered posteriorly only by transversalis fascia.

* Read before the Section on Genito-urinary Surgery of the New York Academy of Medicine, January 15, 1908

The fibres of the recti muscles descend and are inserted on the anterior surface of the symphysis pubis, and the transversalis fascia descends to its insertion on the posterior surface of the same bone. It becomes evident therefore that a space results three cornered in its sagittal section and whose base is equal to the antero-posterior thickness of the os pubis. This space contains loosely woven connective tissue and fat and lodges the deep epigastric artery. This is called by Waldeyer, the prefascial space.

Immediately behind this is a space of greater dimension and representing the true space of Retzius or Cavum Retzii, lying truly speaking retro-mural and prevesical.

Anteriorly is the symphysis pubis and transversalis fascia forming the posterior boundary of the prefascial space.

Posteriorly is a layer of fascia continuous with that covering the floor of the pelvis and stretching over the anterior and lateral walls of the bladder. Usually this space reaches up only to the fold of Douglas but occasionally to the umbilicus.

In its lower part the space is permanently prevesical, lying in front of the bladder even in its collapsed state and behind the symphysis. The lateral limits of this space are bounded on either side by a fold descending from the extremity of the fold of Douglas, these on either side descending as pillars to the symphysis pubis, form portions of the ligaments of Hesselbach. The lowest limits of this space are formed by the reflection of visceral and parietal fasciae upon the floor of the pelvis and immediately overlying the bladder neck, the prostate gland and sometimes part of the posterior urethra. It is of interest to note that both of these spaces are divided by a thin and imperfect median septum.

For the sake of completeness it becomes necessary to mention at this juncture, what has been described as a third space. This is called the preperitoneal space. It contains a thin layer of connective tissue, and lies for the most part on a plane above the bladder. Behind is the peritoneum and in front is a fibrous fasciculus, a continuation of vesical fascia.

Truly speaking this is not a space nor is it of any surgical moment

The present anatomical conception therefore shows a marked deviation from the original one of Retzius, describing

FIG 1

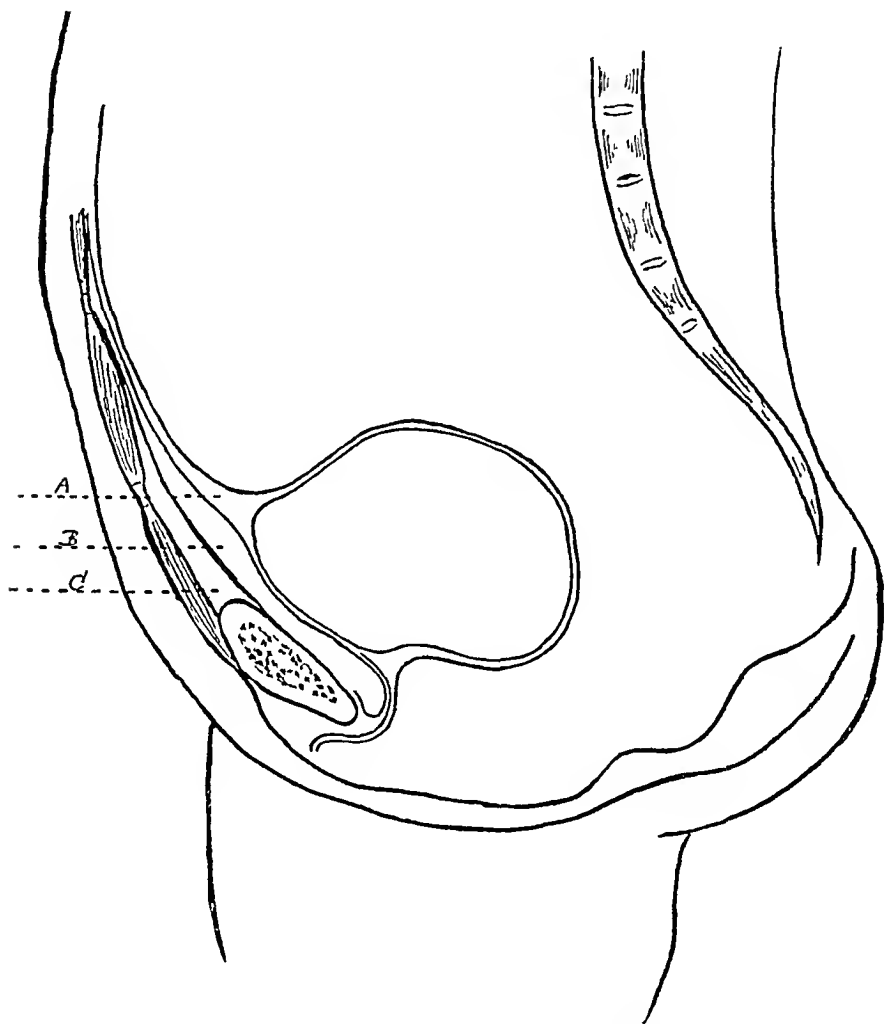


Diagram showing the three spaces constituting the space of Retzius A, Preperitoneal B, Prevesical, C Prefascial

three spaces instead of one, namely 1 Prefascial or retro-muscular space 2 Prevesical space 3 Preperitoneal space

This description is not merely academic but finds its practical application both in an intelligent interpretation of the etiology of infections of this region and in their treatment

Besides fat the prevesical space contains a few lymph glands which have been called anterior vesical lymph glands. These glands were shown by Gerota to drain in part the mucous membrane of the bladder, Cunéo et Marcille having reached similar conclusions. Kuttner by a series of injection experiments showed these anterior vesical glands to communicate with the mucous membrane of the posterior urethra.

Twice Bavy found the anterior vesical glands enlarged at operation, one operation having been performed for vesical calculus and cystitis, the other for malignant tumor of the bladder.

The obscure etiology of prevesical infection has led many observers to overlook the initial causes and to consider many of the cases to be idiopathic in origin. Bouilly considers this a large class as does also Martin, Duplay et Reclus, Le Dentu and Delbet. It seems probable however that prevesical supuration is rarely if ever idiopathic. Steinthal believes the class to be small and Leibold, Michels, Hassler and Honsell deny the occurrence of idiopathic abscess in the Cavum Retzii. A strikingly contrary standpoint to that maintained by Englisch, who believed these abscesses to be a disease *sui generis* and due to a peculiar agent having a selective action upon the prevesical connective tissue.

Honsell agrees with Leibold, who maintains that primary abscess in the prevesical space, is in reality broken down hematoma resulting from traumatic causes. Going a step further he states that such hematomata occur in the prefascial space or as he prefers to call it the retro-muscular space, and therefore not truly in the prevesical space at all.

The question of etiology has been discussed by Bouilly, Guyon, Leusser, Englisch and others. Honsell in his very excellent article adopts the classification of Englisch, who divides these infections into four groups, namely 1 Idiopathic 2 Traumatic 3 Metastatic 4 Secondary. From the foregoing it becomes evident that the groups idiopathic and traumatic fall under the same caption. In fact it would

seem that for all purposes a division into two classes, primary and secondary is all sufficient

The cases hitherto reported as metastatic all have been post-typhoidal Honsell believes that inasmuch as typhoidal abscess shows a proclivity to the long muscles of the abdominal wall, such abscesses in great likelihood would occur in the prefascial and not in the prevesical space If then we chose to be accurate in our terminology both the class names idiopathic and metastatic would fall away A terminology however which would debar from this classification all abscesses occurring in the prefascial space would serve no good purpose and lead only to confusion

In this connection must be mentioned Guyon's reported cases of "*Hygrome de la Bourse Sereuse Prévesical*," wherein serous fluid was found in the prevesical space He suggests the existence of a bursa in this region and of its primary infection as a cause for prevesical abscess

The large class of cases of infection of the prevesical space from traumatic causes distinguishes a class of its own, which demand recognition in this connection only in order to exclude them from the type of case under discussion To this class belong all those cases resulting from infections of the prevesical space from external or internal injury, directly or indirectly applied

Such cases are those resulting from gunshot or stab wounds with or without penetration of the bladder, or fracture of the pelvis All those cases of traumatic rupture of the bladder or urethra with urinary infiltration, or injury to the bladder or urethra following instrumentation such as lithotripsy or catheterization or infection following supra-pubic section or puncture

Eliminating therefore those of traumatic origin, a study of the reported cases of prevesical abscess reveals the fact that by far the great majority of cases bear a distinct relation to foregoing inflammation, and must therefor be considered as secondary

The most prolific cause of suppuration in the prevesical

space is inflammatory conditions of the urethra, prostate and bladder. The primary inflammation may be acute but more often is of an indolent type and likely to be overlooked. Other causes are inflammation of the abdominal wall or sub-peritoneal tissues, suppuration in the pelvic or inguinal lymphatic glands, and osteomyelitis of the os pubis. In the female infection may emanate from diseased internal genital organs, and in children more especially from the intestines.

The following case I am permitted to report through the kindness of Dr. Herman Goldenberg, chief of the Genito-urinary Department of Mount Sinai Hospital. The case is of value because it deserves mention among the list of cases to be mentioned, and furthermore because certain clinical features have been studied which have been neglected in other cases, and which seem to throw much light upon the diagnosis which usually is obscure.

S. C., male, aged 20 years, has had the usual diseases of childhood, has neither cardiac, pulmonary nor nephritic disease. He denies syphilis and gonorrhœa, and is habitually constipated. Present illness began suddenly eight days before admission to the hospital with pain referred chiefly to the rectum and a feeling of soreness in the pelvis which could not be defined. The pain became aggravated in the sitting posture. There was no frequency of urination but some burning and difficulty in starting that act. Two days after the onset of these symptoms the patient had to be catheterized for retention of urine, which after two more days again had to be performed. Since that time the patient has been passing urine at frequent intervals with burning pain, and has had some chilly sensations.

At the time of admission the patient presented normally developed genitals, no urethritis nor evidences of any previous attack. The urine was normal. Rectal examination revealed a prostate somewhat enlarged for a youth of his years, and on the right side was a small area distinctly more tender than the rest of the gland. Cystoscopic examination showed the trigone somewhat injected and "in the interval between the ureteral orifices were several small ulcers to which some mucus shreds were adherent."

The patient was treated by means of instillations of 2 per cent nitrate of silver. He remained ten days in the hospital, during this time the temperature and pulse were normal, the burning sensation on micturition disappeared, and considering himself cured asked for his discharge.

Eleven days afterward the patient returned to the hospital with the statement that he remained entirely free from any disturbance for seven days, he then began to have pain in the hypogastrium difficult to localize accurately. At about this time a hard and rather globular mass appeared in the median line and just above the symphysis. During this time there had been little or no constitutional disturbance. Urination was normal, the urine containing neither blood nor pus. In the hypogastrium and just above the symphysis in the median aspect is a tumor resembling much in outline an enormously distended bladder. This tumor extends to about one and a half inches below the umbilicus and to about two inches to either side of the median line. It is hard, very slightly tender and flat upon percussion. The tumor does not vanish upon catheterization, and when examined bimanually the mass is recognized to be anterior to the bladder. The prostate gland is smaller than when the patient was first seen and is no longer tender. There is a moderate leucocytosis, a differential leucocyte count was not made. The temperature fluctuated daily from 99 to 101.4 and the pulse proportionately.

The cystoscopic examination revealed a most intense oedema bullosum of the entire anterior wall of the bladder with numerous submucous hemorrhages. The trigone was slightly injected, the rest of the bladder was normal.

The patient was treated with Kemps rectal irrigations and later poultices to the hypogastrium. In the course of the following few days, the character of the mass changed somewhat. Its outlines became more diffused and there seemed to be a sense of deep fluctuation. Five days after his second admission the patient was operated upon. A median incision was made over the tumor. Upon a plane just posterior to the rectum and corresponding to the prefascial space was encountered a dense firm fibrous structure three quarters of an inch in thickness, giving much the impression of new growth. This extended laterally for some distance and represented inflammatory induration of the transversalis fascia. Only after extending the incision

through this thickened structure was the abscess cavity reached. The abscess was distinctly in the prevesical space and bore no direct communication to any other focus of infection. Bacterial examination showed the presence of staphylococcus aureus. The patient's recovery was uneventful.

I am led to believe that infection in this case emanated from an infectious nidus in the prostate excited by the catheterization and carried by the lymphatics to the anterior vesical lymph glands, which in their turn went on to suppuration and abscess formation.

In conjunction with the foregoing, a review of the cases from the literature is of interest. The cases divide themselves into the following etiological groups: 1 Infection from the urethra and prostate. 2 Direct infection by perforation of the anterior bladder wall. 3 Infection from adenitis in the vicinity. 4 Infection from the female genital organs. 5 Infection from osteomyelitis of the os pubis. 6 Infection from the intestinal tract. 7 Infection emanating directly from the vermiform appendix.

GROUP 1—*Infection from the urethra and prostate*—as mentioned above this is probably the most prolific cause, and occurring as in the case cited.

CASE 1—MEIGNANT reports two cases both probably of urethral origin. The second case exemplifies well a condition encountered in several of the cases, namely, "abscess en bisac," or hour glass abscess. The primary abscess occurring in the prevesical space perforates the transversalis fascia and infects the prefascial space. The surgeon encountering this condition is likely to drain only the abscess in the prefascial space, overlooking the more serious condition underlying.

CASE 2—PARA ET TUFFIER, female, uterus and adnexa normal, point of origin of infection, urethritis and cystitis. The entire lower segment of the abdominal wall from the symphysis to the umbilicus presented a painful board-like intumescence. The condition found was abscess in the prevesical space with intense inflammatory involvement and thickening of fascial structures of the abdominal wall.

CASE 3—COSTANEDA Y CAMPOS reports case similar to the above, which is, however, of special interest because it ruptured spontaneously.

CASE 4—HASSLER—Bottini operation performed two years previously. Large hypogastric tumor developed in course of several weeks, which proved to be prevesical abscess. Staphylococcus aureus was found.

CASE 5—HOTCHKISS—Old stricture of the urethra and vesical calculus. Transversalis fascia, board-like in character and half inch in thickness. Marked inflammatory reaction, with little or no abscess.

GROUP 2 *Cases following perforation of the anterior bladder wall*—This group of cases is secondary to aggravated cystitis whether that be due to the irritation of calculus or to tuberculosis, and would include cases of direct penetration of infection without apparent perforation. We have seen from the experiments of Gerota the relation of the bladder mucosa to the anterior vesical lymphatics

CASE 1—DUPLAY—Old prostatic with ulcerative cystitis, developed painful tumor in hypogastrium. Autopsy showed perforated ulcer of bladder and infection of prevesical space

CASE 2—CRISTOL reports case similar to the preceding

CASE 3—LEIBOLD—Female, tubercular nephritis and cystitis. Perforating ulcer of anterior of the bladder

CASE 4—HEWETT—Female, 9 years, tubercular cystitis, perforating ulcer infecting prevesical space. Spontaneous rupture. Died

CASE 5—LAUWERS—Male, 19 years, spontaneous rupture of the anterior abdominal wall. Resulting urinary fistula, calculus removed. Recovery

GROUP 3 *Infection from adenitis in the vicinity*

CASE 1—HONSELL—Man, for years having suffered from various tubercular lesions. Suppurating inguinal glands burrowed behind symphysis and infected prevesical space. Hypogastric tumor developed slowly. Abscess cavity found to contain tubercular granulation tissue

GROUP 4 *Infection from the female genital organs*

CASE 1—MICHELS (third case of series)—Although not positively stated, the infection of the prevesical space probably emanates from a ruptured tubal pregnancy

GROUP 5 *Infection following osteomyelitis of the os pubis*—The location of an abscess resulting from osteomyelitis of the os pubis, is determined by the place where the exudate pierces the periosteum. If the periosteum is ruptured in the upper part of the bone, infection will occur in the prefascial or retro-muscular space. If perforation occur in front it will present under the skin, or if below, the planes of least resistance will cause abscess to appear in the scrotum or the labium majus, or in the peri-rectal tissues. If, however, perforation occur upon the posterior surface of the os pubis it

must inevitably lead to infection of the prevesical space. Perforation at this point is least frequent owing to the fact that here the periosteum is re-enforced by the transversalis fascia.

CASE 1 —GRUBER—At autopsy the prevesical space was found the seat of abscess. The prostate gland was normal, but at either side was a channel of communication between the prevesical and ischio-rectal abscesses. On the left side the os pubis for some distance was denuded of its periosteum and the bone was eroded. Whereas the prevesical infection may have emanated from a peri-rectal abscess, I rather believe the infection to have been primary in the os pubis.

CASE 2 —GRENSER—Female, pregnant. Trauma to os pubis followed by fever and later developed hypogastric tumor. Autopsy showed abscess in the prevesical space communicating with large area of caries of pubic bone.

CASE 3 —KIRCHNER—Case of sudden onset in young man 21 years. Symptoms of fever, delirium and pain and later the development of a tumor in the hypogastrium. Incision opened an abscess in the prefascial space which led to the os pubis denuded of its periosteum. The symphysis was infected and an epiphysis lay free in the cavity. The sequestrum was removed and recovery ensued.

GROUP 6 *Infection emanating from the intestinal tract*

CASE 1 —MARTIN—Infant, 16 months old. Etiology is obscure though probably of intestinal origin. Prevesical abscess drained and recovery followed.

CASE 2 —MICHELS (second case of series)—Carcinoma of the intestine ulcerating and infecting the prevesical space.

CASE 3 —GUYON—Case similar to the preceding.

GROUP 7 *Cases following direct infection from the vermiform appendix*

These cases would not be out of place in Group 6, but perhaps they deserve a special grouping.

CASE 1 —BRUN—Boy, 9½ years. Was sick for 14 days with symptoms of acute appendicitis. Gradually there developed a painful tumor in the hypogastrium. The urine having been clear suddenly contained foul pus. Autopsy showed an abscess in the prevesical space. The posterior wall of the abscess cavity was formed by the anterior bladder wall and peritoneum. The appendix lost itself in adhesions in the posterior wall of the abscess cavity, its lumen communicating directly with same. A second perforation opened freely into the peritoneal cavity.

CASE 2 —TUFFIER cites a similar case which however recovered after draining the abscess cavity, a fecal fistula persisted, until an intra-

abdominal operation was undertaken The appendix was found to be the cause Recovery followed

Leusser, Englisch, Bouilly, Guyon and Gerardin have attempted to delineate the clinical sequence of this disease, dividing the symptoms into stages It is apparent that no such periods can occur in a condition dependable upon so many different causes Nor does any one clinical picture portray its many manifestations

Bouilly, Leusser and Englisch divide the symptoms into two groups first, prodromal, second, tumor formation Hon-sell correctly says, no periods exist, some cases begin with tumors and in others death may supervene before that event Although most of the cases have occurred in adult life neither infancy nor childhood precludes that condition, one case having occurred at the age of 16 months, and another at 9 years The condition is more frequent in the male but a fair proportion of the cases have occurred in the female

In consequence of the fact that infection of the prevesical space is practically always, except in traumatic cases, secondarily invaded, there must precede a group of symptoms referable to that primary lesion Without entering upon the symptoms of that primary group, whether that be symptoms of cystitis, osteomyelitis or appendicitis, there comes a moment when the prevesical space becomes invaded and from that time on there is a similarity of symptoms Pain is a prominent symptom, it is not necessarily severe It is difficult to locate in the milder cases and gives the sensation of pressure or weight in the pelvis There is some tenderness which becomes marked only with the appearance of the tumor The patient stoops forward in walking or standing in order to prevent contraction of the abdominal muscles The tumor may appear early, but in most of the reported cases appeared late The formation of a tumor in this region rather than a diffuse phlegmon is due to the distribution of dense fasciae preventing the dissemination of inflammatory materials, and as a result of that an enormous thickening of the fibrous

walls of this space The tumor is usually in the median line, but may be somewhat to one or the other side

In outline when seen early it is globular and appears above the brim of the pelvis, later its lines become more diffused and at a still later period may no longer be globular, but gives the impression of a board-like hardness to the lower part of the abdominal wall Fluctuation if it occurs at all appears late and only after the abscess has perforated into the prefascial space, producing an abscess "en bisac" or hour glass abscess There may be no urinary symptoms unless the bladder becomes secondarily involved. Constitutional symptoms are variable but are usually mild

The bacteriology of prevesical abscess has not been satisfactorily investigated In my case the organism was staphylococcus aureus, this organism was found also in one other case in which the bacteriology was studied In Honsell's case tubercle was found

The very significant cystoscopic finding in the case described above has led me to believe that this may be an accompaniment of all cases of prevesical suppuration, and therefore a valuable sign in the diagnosis of that condition I refer not only to the oedema bullosum but also to its limited distribution to the anterior bladder wall

A remarkable issue of these prevesical inflammatory tumors is their spontaneous resolution This has frequently been observed Merkel reports one case in a series of 5, and Cotte, quoting Villiers, mentions this occurrence five times in a series collected by him of 53 cases Resolution is accompanied by subsidence of fever pain and the gradual disappearance of the tumor The usual termination, however, is by suppuration which if not relieved by incision ruptures spontaneously A most unfortunate termination is by perforation into the peritoneal cavity, an event which has been observed 10 times Spontaneous rupture externally usually occurs in the median line and occasionally by multiple perforation Rupture into the bladder and rectum has also been observed

BIBLIOGRAPHY

- Bruns Annales Genito-urin, 1897
 Bavy Bull de la Soc de chir, 1899
 Bouilly Les tumeurs aigues et chroniques de la cavite prevesicale, These, 1880
 Cristol Du phlegmon prevesical, Montpellier, These, 1887
 Castaneda y Campos Du phlegmon de la cavite preperitoneal de Retzius, Paris, These, 1878
 Cotte Abces de la cavite de Retzius Gaz d hop, 1905, lxxviii
 Duplay Arch gener Mai, 1877
 Duplay et Reclus Trait de chir, vol vi, p 316
 Englisch Weiner klin, 1889, No 12, 1896, No 1
 Greuser Monatsch f Geburt, T xii
 Gerardin La cavite properit de Retzius, Paris, These, 1879
 Geraudie Contr a l'etude pathogen des phlegmons de la cavite de Retzius Montpellier, These, 1903
 Gruber Virch arch, 1862, Md 24
 Guyon Gaz d hop, 1891, p 1262
 Hewett Med Times, 1874, 11 p 673
 Hotchkiss Chron prevesical inflammation Ann Surg, 1896, xxiii
 Hassler Centr f Harn & Sexual Org, 1902, p 377
 Honsell Ueber die abscesse des spat preves Beitr f klin chir, vol 41, p 491
 Kirchner Arch f klin chir, Bd 58, p 317
 Lauwers Centr f chir, 1902, p 1121
 Le Dentu et Delbet Traite de chir, vol vii, p 409
 Leusser Arch f klin chir, 1885, vol xxvii
 Leibold Ueber abscesse im sog Cav Retziu in dis Berlin, 1894
 Meignant Des pericystites suppurees Paris, These, 1895
 Merkel Ueber die phlegmone des Cav Retzius Munch Med Woch, 1905, lii, p 2543
 Martin Diagnostik der Bauchgeschwulste
 Michels On prevesical abscess Trans Med & Chir Soc, 1896, vol lxxix
 Martin Annals des Mal d Org Gen-urin, Jan, 1893
 Para et Tuffier Progres Med, 1885, p 441
 Power Lond Path soc trans, 1888, p 172
 Reygasse A propos de l'origine infectieuse lymphatique des phlegmons de la cavite de Retzius Languedoc Med et chir, 1905, xiii
 Steinthal Handbuch der prakt chir
 Tuffier Semaine Med, 1894, p 557

SYMPTOMLESS HEMATURIA.¹

REPORT OF THREE CASES IN WHICH HEMORRHAGE CEASED AFTER CATHETERIZATION OF THE URETERS

BY FRANCIS R HAGNER, M D,

OF WASHINGTON, D C,

Professor of Genito urinary Surgery in the George Washington University

IN reporting these cases I do not pretend to claim that ureteral catheterization has cured them, and only state the facts in each case. It is rather interesting to note that immediately following ureteral catheterization blood disappeared in these 3 cases, and up to the present time has not returned.

CASE I—Male, 45, carpenter. He was first seen by me in November, 1905. His previous history was negative, no history of any trauma. Six months before I saw him he noticed blood in the urine that has continued unintermittingly. No frequency, pains or symptoms of any urinary irritation. There was a slight loss of weight but he did not appear anaemic. The urine passed was very bloody. Sp. Gr. 1020, acid reaction and a trace of albumin—the microscopical examination was negative except for blood and a few leucocytes.

Cystoscopic examination November 10, 1905. Bladder capacity, 300 c c. Mucous membrane of bladder normal, blood seen flowing from the right ureter. Both ureters were catheterized, ureteral catheters passing to the kidney pelvis without obstruction. The urine collected from the right ureter showed blood and a few leucocytes, otherwise normal, that from the left ureter was perfectly normal. There were no more white cells present than could be accounted for by the amount of blood seen. Examination of urine 24 hours after ureteral catheterization showed clear urine apparently free from blood, but on microscopical examination a few red cells were noted. Forty-eight

* Read before the American Urological Association, Atlantic City, June 5, 1907.

hours after ureteral catheterization the urine was clear and no blood cells could be found on microscopical examination The blood has never recurred in the urine up to the present time, 20 months after ureteral catheterization

CASE II—This case was referred to me by Dr Mason Male, 53 Past history negative One and a half months before I saw the patient his wife noticed that he was passing bloody urine, three days before this symptom was noted the patient was working on a roof supported by a rope tied around his waist At the time I saw him he had never had any symptoms other than the blood in the urine When examined I found him to be a well preserved man, slightly anaemic On passing his urine it was noted that it contained a large amount of blood The blood had continued without cessation for a month and a half Cystoscopic examination revealed a normal bladder mucosa and showed bloody urine escaping from the right ureter Catheterization of the two ureters showed bloody urine from the right side that contained no abnormal elements except the red blood cells, while that from the left side was perfectly normal An examination of the mixed urines was negative except for the blood The day following the ureteral catheterization the urine was perfectly free from blood It is now three and one half years afterwards There has never been any recurrence of blood in the urine and in all this time the patient has been in good health

CASE III—R M, 56 years of age, bank cashier from Virginia This patient was first seen by me in October, 1906 Previous history, pneumonia at 21, sick two months, recovered, no venereal diseases During the same year that he had pneumonia his urine became bloody At times the blood would almost disappear, but exposure, indigestion or exercise would cause a recurrence There was no pain when bleeding would occur except when clots would be present in the urine This was 35 years before he was seen by me As a young man he consulted a number of prominent surgeons among the number being Dr Nathan R Smith of Baltimore, Dr Hunter McGuire and others He was advised against any operative procedure

During the last 15 or 20 years the blood has been much greater in amount and much more constantly greater than during the early years of his illness He has never had any pain in

the bladder or symptoms of vesical irritation. He has never complained of any symptoms other than that of blood in the urine for 35 years except he has had what he describes as attacks of lumbago. From what he says there is possibly some relation between the passage of clots and these attacks of lumbago which he describes. He says that the blood is always seen to be intimately mixed with the urine, but at times is more abundant in the last urine passed. The patient is an educated man and one I believe whose statements can be relied upon. He assured me that his urine had never been free from blood for 35 years and his present physician said it had been so to his personal knowledge for 17 years. At times the urine would be vermilion color, at other times it would vary between a port wine and almost inky blackness.

On examination it was seen that the patient was anaemic, emaciated and had the appearance of being a very ill man. On palpation of the kidneys no tumor could be felt and deep pressure elicited no more pain on one side than on the other. The other genito-urinary organs appeared normal. The urine passed by the patient was very bloody being the color of port wine and the last urine passed contained some small clots. Examination both chemically and microscopically of the urine was absolutely negative except for blood.

Cystoscopic examination on October 25, 1906, showed a normal bladder and very bloody urine escaping from the right ureter, both ureters were catheterized both catheters appearing to pass to the pelvis of the kidney without obstruction. Clear normal urine escaped from the left side while very bloody port wine colored urine escaped from the right side. Microscopical examination of the left urine was perfectly normal that from the right showed very numerous red cells and a few leucocytes. When I visited the patient at the Garfield Hospital 24 hours after ureteral catheterization he informed me that the bleeding had stopped. On examination the urine seemed to be clear and microscopical examination showed only a few red blood cells. I insisted on his having an X-ray picture taken, but he wished to go home first. As the bleeding has not recurred he has neglected to return to Washington. I have been in constant communica-

tion with him for the past twelve months. He has informed me that his health is better than it has been in years, he has gained weight, strength, and has no recurrence of the hemorrhage whatsoever.

NOTE.—Since this article went to press I have examined the patient referred to as Case 3. He has gained 26 pounds and appears in perfect health. He has had frequent microscopical examinations of his urine and at no time has any blood been noted. It is now 17 months since his ureters were catheterized.

CYSTIC DEGENERATION OF THE KIDNEY.

BY CLARENCE M. NICHOLSON, M D,

OF ST LOUIS, MO

Professor of Practice of Surgery and Clinical Surgery, Medical Department,
St Louis University

CASE—Mrs H M J, age 46, married, referred to me by Dr W C Lewis, was admitted to the Rebekah Hospital August 13, 1906 During the five years previous she had complained of difficulty in breathing which at times was very severe, the attack would last from one half to four hours Whiskey and other home remedies were made use of and on some occasions artificial respiration was resorted to She occasionally complained of nausea, but never vomited Five months ago she noticed an enlargement in the left lumbar region which rapidly increased in size

Examination—Urine from left kidney highly colored, specific gravity 1028, sediment, normal, blood, slight in amount, casts, both hyaline and granular Urine from right kidney normal A mass extending from the symphysis pubis upward to the left, behind the lower ribs, could be made out, approximately six or seven inches in diameter and twenty-one inches in length There was some tenderness

Operation—A median incision showed the opposite kidney was not enlarged A right lumbar incision exposed a multilocular cystic kidney, the visible cysts varying in size from a split pea to an orange The size of the mass precluded the possibility of delivery through the incision in the loin until after thirty or forty cysts had been punctured The vessels and ureter were separately ligated, the remaining mass removed and the cavity packed with sterile gauze Convalescence was uneventful, the patient leaving the hospital six weeks later, after eighteen months she remains entirely well

Under the name Cystic Degeneration, has been described a peculiar lesion manifested by the presence of multilocular cysts, occupying the area of and replacing the kidney Frequently cystic kidneys contain no discernable renal tissue; in

other instances only part of the kidney is involved. The disease often exists for years, no diagnosis being made owing to entire absence of symptoms, while not infrequently sudden death takes place from uremia or cerebral hemorrhage due to kidney insufficiency.

Cystic kidney in the new-born has long been recognized. Fussell collected eleven cases in which it was necessary to mutilate the fetus in order to accomplish delivery. The tumors in the adult may be of enormous bulk weighing (as in Hare's case) as much as twenty-four pounds. These tumors are usually bilateral and may increase in size under observation.

Hematuria, sclerosis of arteries, hypertrophy of heart with accentuated second sound, and albuminous urine are among the more common symptoms. Cystic kidney occasionally, as in the case here reported, occupies a large portion of the abdominal cavity. It is made up of numerous cysts varying in size from a pin head to a cocoanut and little or no recognizable renal tissue may be found. The fluid within the cysts is clear, slightly albuminous, presenting cholesterol, blood pigment and detritus resulting from degenerative and necrotic processes in the epithelium of the cystic wall. In some instances the connective tissue of the cyst is not covered by a recognizable amount of epithelium, in other instances epithelium, when found, varies in amount, both granular and necrotic, and in still other specimens columnar epithelial cells from the inner layer of the cyst wall are found. The matrix between the epithelial cell may be fibrous or myxomatous and is not infrequently extremely vascular.

Our lack of knowledge of the etiology of these cysts has given rise to much discussion. The earliest theory, that of Virchow, was that they were due to an obstruction of the tubules. Later he expressed a belief that cystic kidney was due to an intra-uterine papillitis, this view was reaffirmed by him in 1892.

Arnold, regarded the process as beginning in the pelvis of the kidney and speaks of the lesion as an "ascending pyelopapillitis fibrosa." The inflammatory origin of cystic

kidney, founded on the great increase of connective tissue in the pyramids and the numerous foci of round-celled proliferation present has been supported by Thorne

Brigidi and Severi, in 1880, basing their opinion upon epithelial sprouts into the surrounding connective tissue from the walls of the tubules, especially of the straight tubules, also an increase in the layers of the tubules and proliferations of epithelium in continuity, so that the epithelium appears contorted within the lumen, claimed that cystic kidney bore marks of a tumor and called it multilocular adenocystoma, this point of view though confirmed by Chotinsky, Nauwerck, Hufschmidt, Janowski, Kahlden, Hain and Alber was declared by Marchand to be untenable Durlach believes it due to a proliferation between the lobules of the kidney, that is, of tubules between the pyramids and their outlying cortex Leichtenstein thinks it begins as an inflammation or inflammatory irritation in the arteriolæ rectæ, which are small vessels between straight tubules and give striations to pyramids

Shaddock concludes that the condition depends on the mal-development of mesonephron or the Wolffian body fused with the metanephron and that the cysts result from the evolutionary changes in the included mesonephron Van Mutach recognized from a microscopic point of view striking embryonal characteristics of cystic kidney

Hildebrant explained the condition on purely embryological grounds Deetmar, Schenkl and Rukert accept cystic kidney simply as a form of mal-development of the organ

Milward divides the clinical history of the disease into three stages

- 1 The stage of progressive enlargement of one or both kidneys without subjective symptoms The renal enlargement is discovered, if at all, by accident This stage may last from a few months to several years

- 2 The stage of subjective symptoms and objective signs This stage lasts from a few months to seven or eight years, or even longer The signs and symptoms are dependent on the size and weight of the tumors

3 The stage of decreasing elimination of urine In this stage appear the symptoms of uremia, or cerebral complications This disease which affects males and females in about equal proportion usually terminates fatally about the age of forty-five The symptoms of the second stage are dull, aching pain in the region of the kidney Flatulence, headache, dyspepsia, vomiting, anorexia and constipation are frequently met with Examination of the urine may throw very little light on the diagnosis, though the specific gravity is usually low and the amount passed is generally slightly increased A trace of albumen is usually found, but is never present in large quantity in the second stage except when there is a large amount of blood Leucocytes may be met with in large numbers and pus is often present Blood is usually present and may occur at intervals of weeks, months or years or may never be noticeable by macroscopical examination of the urine, though according to Milward it is always present and is significant The symptoms of the third stage are those of uremia

The treatment for congenital cystic kidney consists of removal of the organ, unless the other kidney is diseased which can only be positively determined by exploratory incision While Schmidt, Neimeyer, Bardeleben, Hayems and others have performed nephrectomy for polycystic kidneys, the patients having died of uremia, the opposite kidney has in all cases been found to be the seat of rather extensive disease Where the opposite kidney is involved an incision through the loin, puncturing the cysts and stitching the kidney to the lumbar muscles is the procedure indicated

Pathological Examination of the Specimen Removed in the Case Reported—GROSS The kidney after evacuation of the larger cysts weighed 1,400 gms It is 24 cm in length and 15 cm in width, and the shape is almost rectangular The anterior surface is studded with small cysts varying in size from almost microscopical points to the size of a walnut (Fig 1) They bulge outward prominently, giving the kidney the appearance of a bunch of grapes The superficial cysts have very thin walls and are transparent They are light yellow to brownish-yellow in color The posterior surface is similar to the anterior, however, the cysts are not so prominent The pelvis of the kidney is narrow and extends deep between

the upper and lower overhanging projections of cyst masses. The vessels entering are large, but not thickened. The ureter is not dilated.

In making the incision for the cut surface, the organ is laid open in its longest diameter, the incision being made from the convex surface toward what constitutes the pelvis. This cut passes thirty-three cysts, each larger than a pea (Fig 2). The cut surface of the kidney shows little kidney tissue recognizable as such. No striations can be seen. The surface has a honeycombed appearance. The color of the kidney substance is grayish. The largest cyst is at the upper, inner pole, and has a diameter of $7\frac{1}{2}$ cm. It is deep, round, and lined with a smooth surface, and crossed by falciform trabeculae in part. It has five depressions, about $1\frac{1}{2}$ cm in diameter, which have the appearance as if five small cysts had coalesced and formed the large one. Shining through the wall of the lower inner depression are seen two black cysts. The contents of the cysts are in part clear serous fluid, others contain a jelly-like colloid material. Some contain a purulent material, and others a black hemorrhagic fluid, or are clouded with a brown substance. Numerous smaller cysts are seen on the cut surface of the kidney. They are mostly round and form hollow spaces. Their septa and walls show traces of kidney parenchyma. The cyst contents is alkaline in reaction and contains albumin. Microscopically it shows red blood cells and leucocytes with granular degeneration. Fat is shown to be present by Sudan III stain. The calyces are only rudimentary and are distorted by compression of the cysts. Their lining is smooth and pink in color. The walls are thicker than normal. There is considerable pelvic fat.

MICROSCOPIC Section 1—Showing one of the smallest cysts. The cyst content is not stained. The cyst is lined by tubular epithelium which is slightly flattened. The protoplasm of the cells is granular and not stained as deeply as normal. The nuclei show a vesicular condition. They are nearly all large and contain less chromatin than do the nuclei of normal tubular epithelium. The connective tissue surrounding the cyst is increased, and is rich in nuclei. The tubuli contorti are increased in number and apparently widened. Their lining epithelium is wider than that lining the cyst and takes a deeper stain (Figs 3 and 4). The glomeruli do not differ from those of a normal kidney. They are normal in number and size. Their capsule is not thickened.

Section 2—Showing wall of a microscopic cyst smaller than a pea (Fig 5). The content is not stained. The lining epithelium is much flattened and faintly stained. In places it is detached or absent. The connective tissue shows greater increase in nuclei than in previous section and replaces tubules to some extent. The picture is similar to that of a chronic interstitial nephritis. There is marked infiltration of lymphocytes. The tubules are elongated and flattened so that their lumina are filled. The glomeruli are distorted and deformed by pressure and the capsule of Bowman is thickened. Some glomerular tufts show vacuolization. It is probably a hydropic degeneration, however, no fat is seen by staining with Scharlach. The blood vessels are thickened, chiefly the tunica

muscularis The lumina are large and filled with blood in the region near cysts

Section 3—Showing wall of a hemorrhagic cyst the size of a pea (Fig 6) The content consists of blood pigment, degenerated epithelial cells and detritus The epithelial lining of the cyst is absent, so that only a connective tissue lining is seen, which is wide and shows irregular heaps of new-formed nuclei There are no tubules present Some glomeruli are present, but show a more advanced stage of degeneration than in the previously described sections They are small with greatly thickened capsules The tufts fill the capsule only in part The blood vessels are greatly dilated

CONCLUSIONS

I In the cells lining the cysts, the entire row are alike, and apparently in the same stage of secretion, that is, the nuclei are poor in chromatin and show a vesicular condition In the normal convoluted tubules, this condition is present in a few cells only while very many are rich in chromatin and show filaments or striations known as "ergastoplasm" This condition of the normal convoluted tubules is met with in active secreting cells While the condition of the cells lining the cyst would correspond to a stage in secreting activity, it is not probable, however, that the entire row lining the cyst would show the same stage in secretion because we have no proof that secretion occurs in cells simultaneously Therefore in my opinion the cells lining the cysts are less active in secreting power than normal epithelium

II These various theories of the origin of cystic kidneys have been discussed previously in this article From the study of the microscopical sections I find that the smallest cysts are lined with the same epithelium as that lining in the convoluted tubules Therefore, one must conclude that the cysts originate in the convoluted tubules by dilatation and proliferation, lining epithelium In this kidney I can say with certainty that the cysts do not arise in the glomeruli, the blood vessels or the connective tissue

FIG 1



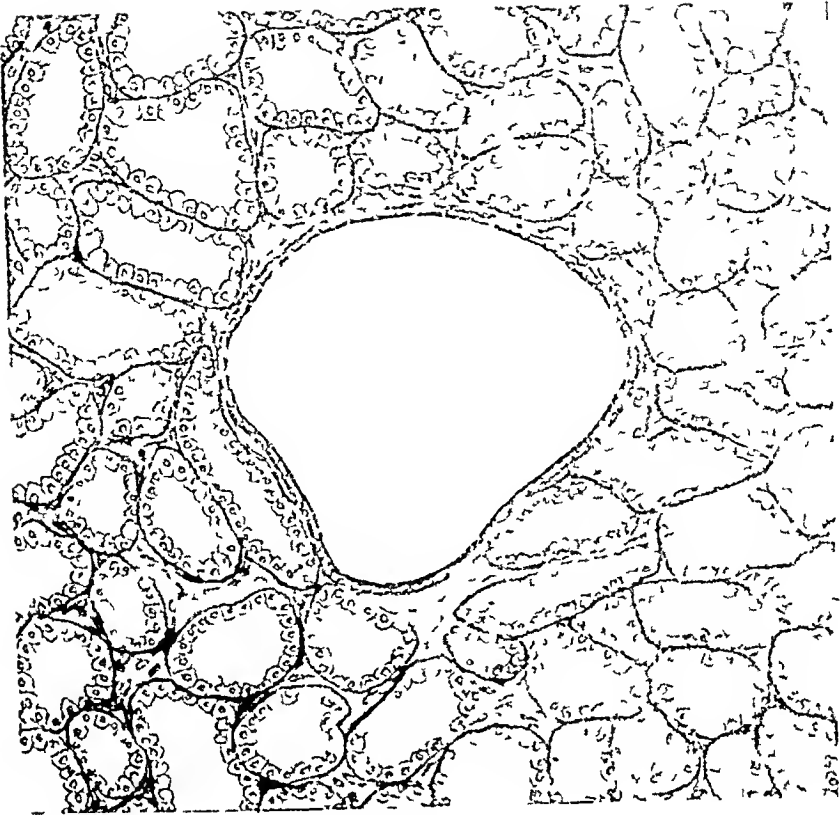
External surface of cystic kidney extending from the brim of the true pelvis to the angle of the scapula moved at operation from patient of Dr E K Lewis Recovery

FIG 2



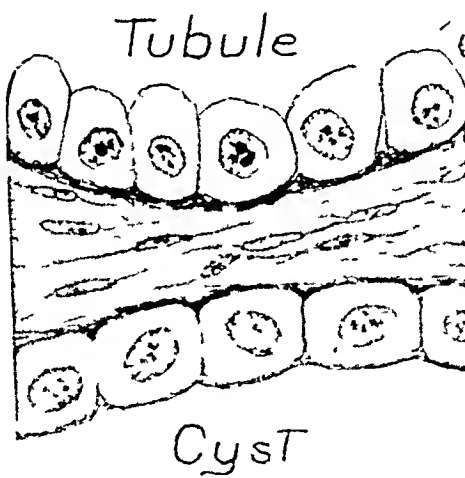
Transverse section of Fig 1

FIG 3



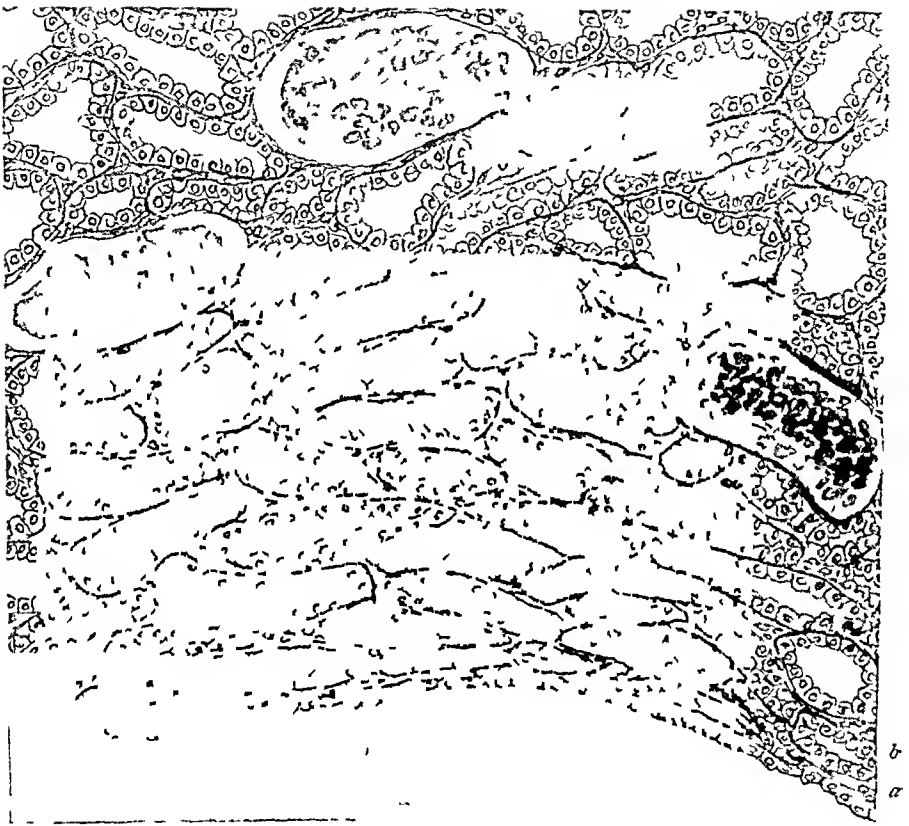
Microscopical appearance obj 3 of one of the smallest cysts from section 1

FIG 4



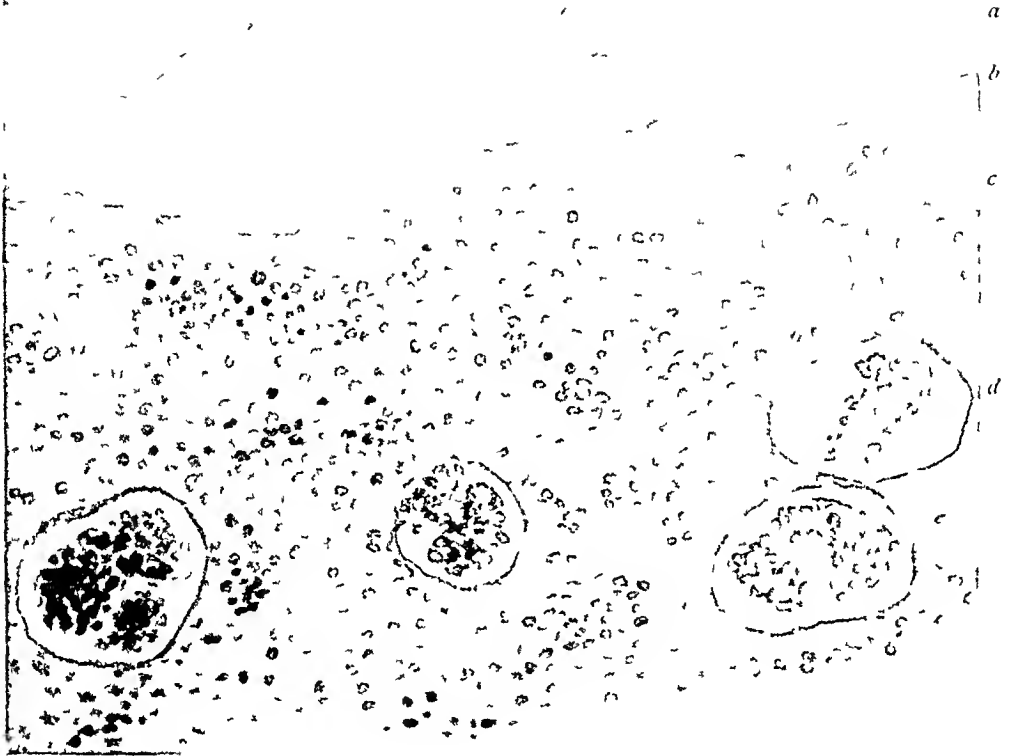
High power obj 3, showing lining of cyst and tubule from section 1

FIG 5



Microscopical appearance of wall of a cyst smaller than a pea from section 2 a cyst lining b flattened tubules

FIG 6



Microscopical appearance of wall of a hemorrhagic cyst the size of a pea from section 3 *a* blood pigment *b* connective tissue lining *c* round cell infiltration *d* degenerated glomeruli No convoluted tubules are seen

VENOUS THROMBOSIS AND HYDROCELE OF THE INGUINAL CANAL.

BY JOSEPH RANSOHOFF, M D , F R C S (ENG),

OF CINCINNATI, OHIO,

Professor of Surgery in the University of Cincinnati

CONSIDERING varicosities of the pampiniform plexus, the rarity of thrombosis in them is striking. In varicosities of the lower extremity and of the rectum clotting and inflammation are of frequent occurrence. In the rare instances in which I have seen a varicocele thus affected, the process has, for the most part, been limited to the distal radicals and always in close relationship to the testicles and the tunica vaginalis. In contra-distinction to these cases I beg to call attention to thrombosis of the spermatic vein occurring higher up and in the inguinal canal, and leaving intact the lower vein radicals.

The long course of the spermatic vein and the comparatively slight amount of blood, which in an auxiliary way flows from the testicle through the deferential vein, would seem to make it a favorable place for stagnation in the blood column and thrombosis. It would seem that by violent effort, by direct injuries or by pressure of a truss, thrombosis with its usual sequences would be of common observation. Either this is not the case, or the condition, if observed, may have seemed so trivial as not to have been deemed worthy of record. At least in my study of relevant literature I have found nothing bearing on the subject. Nevertheless in the last few years I have seen three distinct cases of thrombosis in the spermatic cord within the canal, each affecting an adult without varicocele. I beg to submit a brief history of the cases.

CASE I —J W F, aged 43, married, and of excellent habits. Has no history of venereal disease or of hernia. After violent

* Read before the Southern Surgical and Gynecological Association, December, 1907.

exercise at tennis he suddenly experienced very sharp pain in the groin attended with nausea and slight vomiting. When seen twenty-four hours after the onset there was some acceleration of the pulse rate and the temperature had risen to 102. After the third day the temperature had entirely subsided and continued normal. The first examination showed a very marked tenderness in the upper part of the scrotum, and the presence of a firm cylindrical swelling, evidently of the cord, extended into the inguinal canal, but failing by more than an inch to reach the epididymis. At the lower end a bifurcation of the induration could easily be felt. As far as it could be palpated the cord presented the feel of a thrombosed vein. Forty-eight hours after the onset, there developed a tenderness and a slight swelling of the epididymis, although the enlargement of the cord did not extend downwards. There was no enlargement of the external ring, nor could any impulse on coughing be elicited. Under purely expectant treatment and rest in bed, the condition gradually subsided, and in about ten days the restitution to the normal was complete.

CASE II—S. G., aged 52, married. Has had several attacks of gonorrhea, the last one twenty-eight years ago. Has never had a hernia. He ascribes his condition to excessive golfing, but is not aware of having injured himself by any single violent effort. He presented himself at the office because of a dull pain in the groin, which had continued without abatement for one week. The pain was not severe enough to keep him from his work. There were no constitutional symptoms at any time. Through the thin abdominal wall the intra-canalous portion of the cord could be readily palpated. It was very tender to the touch, distinctly indurated and nearly as large as the little finger. Traced downward the induration could be felt in the upper part of the scrotum and was gradually lost in the lower part of the cord. Neither the testicle nor the epididymis was involved at any time. As in the previous case, the condition disappeared slowly in a little over three weeks.

CASE III—S. R., aged 49, widower. Has no history of venereal disease. He has had a reducible right inguinal hernia for many years, for which he has recently had a new truss fitted. To this he ascribes his present illness, which began with pain in the region of the hernia sufficiently severe to confine him to his bed. When first seen he had slight elevation of temperature

and some malaise consequent thereon. There was some little nausea, but no vomiting. The bowels moved readily on slight stimulation. An examination showed the abdominal wall over the canal very much relaxed as one sees it after the long wearing of a truss. The hernial opening was large enough to readily admit the finger. It was empty but very tender. On my second examination, twenty-four hours later, there could be felt within it a tender cord running into the scrotum and not quite reaching the epididymis. During the next few days the latter became somewhat tender and sore. There was at no time any effusion into the tunica vaginalis. Three weeks in bed with rest sufficed to cause the induration in the cord to gradually disappear. Although more than a year has passed since the attack and the patient has continued wearing the truss, there has been no recurrence.

In each of these cases I have recently examined the spermatic cord and found it normal. While we are led to believe, and in the majority of cases it doubtless is true, that thrombosis of a vein recovers with the formation of a fibrous cord which remains, in these cases it is probable that by a process of liquefaction and absorption of the thrombus an entire restitution even to the calibre of the veins took place. In none of the cases was there any justification for operation, wherefore the clinical diagnosis of thrombosis of the spermatic vein might be questioned. In each of them an infective process could be positively excluded, and except in the third case a hernia did not exist. The slight participation of the testicle and the epididymis in the process and its secondary nature preclude even the suspicion of an ordinary epididymitis. All of the cases were on the right side.

With the exclusion of the most common etiological cause of thrombosis, namely, bacterial invasion, we must look to some mechanical obstruction or trauma from very violent muscular action as to the cause of the thrombosis in these cases. Whereas it is well known that even prolonged compression of a vessel as of the carotid artery in prevention of hemorrhage in major operations about the head is not followed by thrombosis,

this condition is much more likely to arise in thin walled veins with their many small and irregular tributaries. It appears to me that the cases described are a mild type of the condition following torsion of the cord, to which attention has quite recently been directed. In torsion of the cord, however, the symptoms are exceedingly severe and associated with symptoms of abdominal shock. In 70 per cent of the cases collected by Bochdaneck castration became imperative by reason of gangrene of the testicle. In the great majority of cases the diagnosis of torsion of the cord was not made, and the operations were for the most part performed under the belief that there existed a strangulated hernia.

Fortunately I have had two opportunities of verifying the diagnosis of thrombosis of the spermatic vein by operation.

CASE IV —J C, aged 38, admitted to the Cincinnati Hospital, January 21, 1899. Has had a previous history of malaria. On January 9th while working on a flat car unloading timber, a jack-block struck him in the groin. He was knocked off the car, but did not lose consciousness at any time. With assistance he was enabled to walk to his home. Twenty-four hours after the injury was sustained, he noticed a swelling in the left groin and severe paroxysmal pains. The bowels moved regularly and there was no nausea nor vomiting at any time. He remained in bed for about two weeks, during which he states the swelling diminished and the pain in the groin abated somewhat.

Examination negative except for local condition. Over the abdomen there is a bluish-green discoloration of the skin near the anterior superior spinous process. This is evidently the result of a superficial ecchymosis. The left testicle hangs much lower than the right. In the cord for about two inches distinct irregular thickenings of the vein can be felt. The ring distinctly patulous admits the finger which comes in contact with a hard circumscribed swelling an inch or more long. It is of a diameter of the little finger and appears to have a distinct impulse on coughing. The cord feels like a thrombosed vein.

Operation January 23, 1899. General anesthesia. Incision over the external abdominal ring extending into the scrotum. Easy exposure of the thrombosed vein. The further steps of

the operation consisted of splitting the aponeurosis of the external abdominal oblique and thorough exposure of the contents of the inguinal canal. In this there was found an unoccupied narrow vaginal prolongation of the peritoneum and underneath it the cord with the vas deferens hidden from view by the thrombosed vein which extended quite into the internal ring. The thrombosed part of the vein, irregular in diameter and about two inches long, was resected. The operation was completed as an ordinary Bassini. The patient made an uninterrupted recovery and was discharged February 16, 1899.

This case was the nearest approach I have seen to a hernia resulting from a direct injury. The presence of a partly open peritoneal process directs attention to the possibility of an effusion into it as a result of the thrombosis, if the late^r had not been relieved by operation. When this process does not exist, a hydrocele within the canal can probably not develop. But in the presence of such a process, a thrombosis might, as in the following cases, be followed by a hydrocele of the cord, which, because of its rapid growth, might, and doubtless does, overshadow its cause, namely, a thrombosed vein.

CASE V—Father M. K., aged 59, parochial priest. Was first seen November 24, 1906. For eight years he has had a right reducible inguinal hernia for which he has worn a truss. Ten days ago there appeared in the right inguinal canal a hard tender mass which has prevented him from wearing the truss. Notwithstanding this the rupture has not descended. Within the last two days a second swelling causing much pain appeared in the upper part of the scrotum.

Physical examination shows a well nourished man, well except for local condition. On inversion of the scrotum an irregular nodular tumor can be felt in the inguinal canal which is very firm and rather tender. Below this in the upper part of the scrotum, there is a swelling as large as a plum of uniform outline and very sensitive. The tip of the finger passed through the inguinal canal above the upper swelling readily enters the abdomen and an impulse on coughing can be readily felt. The

diagnosis of thrombosis with secondary cyst formation in the cord was made

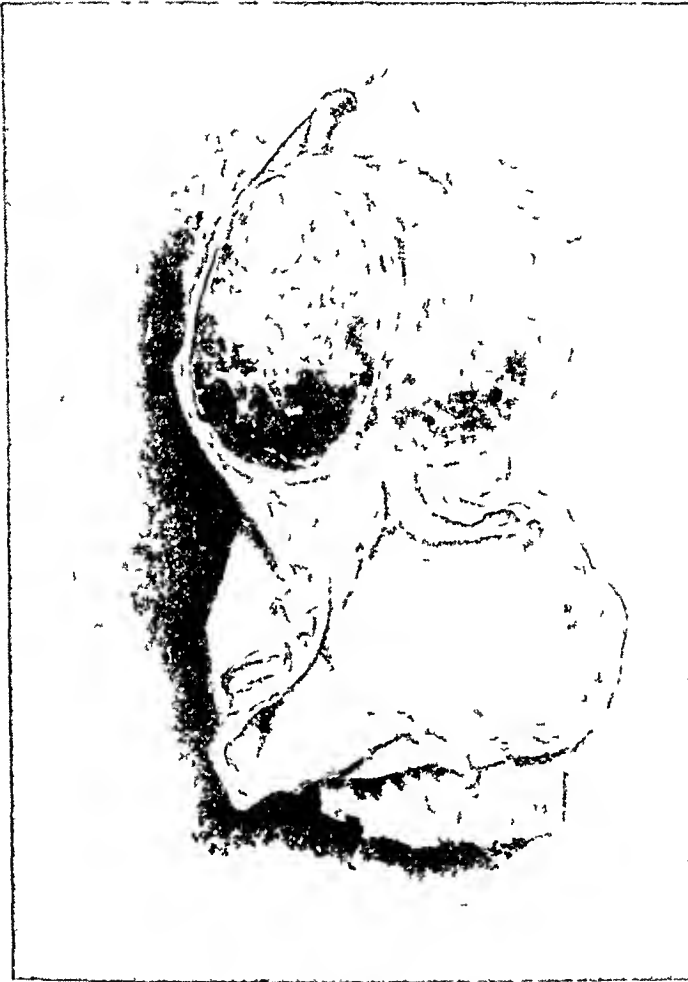
Operation at the Good Samaritan Hospital, December 1, 1906 On splitting the aponeurosis of the external oblique as in the ordinary hernia, there was exposed in the cord a thrombus in process of organization The vein above the thrombus was patulous The clot measured an inch and a quarter in length and three quarters of an inch in width It was of dark red color and of uniform consistence and outline Below it there was a hydrocele of the cord containing perfectly clear fluid and with a sac of uniform surface and clothed with endothelium (Fig 1) The hernial protrusion of the peritoneum was separated by a considerable interval from the uppermost portion of the thrombus The thrombus and hydrocele of the sac were easily excised, and the hernia treated in the ordinary way Recovery was uninterrupted There has been no recurrence either of the hernia or of the hydrocele

CASE VI—Miss R. F., aged 28 Entered the Jewish Hospital, February 18, 1901 Has been well until four months ago, when after a severe strain she felt considerable pain in the right inguinal region Although it caused her to limp some, it did not keep her from her work as a saleslady She had quite forgotten this seemingly trifling condition, when about the first of December she noticed a swelling in the groin which gradually increased in size and without any special symptoms When lying down it disappeared A physician was consulted who advised the wearing of a truss She continued to wear this for about two weeks without benefit

Physical Examination—Well developed young woman, in excellent health except for the local trouble Occupying the upper part of the right labium majus and the inguinal canal, there is a rounded swelling with long axis parallel to Poupart's ligament Above the latter nearly to the superior spinous processes a marked fulness is perceptible On lying down the swelling of the labium disappears either spontaneously or on pressure, and the examining hand on the abdomen can readily feel the distension of the upper portion of the sac A distinct impulse on coughing exists With the patient standing, the translucency of the labial part of the sac is easily demonstrable

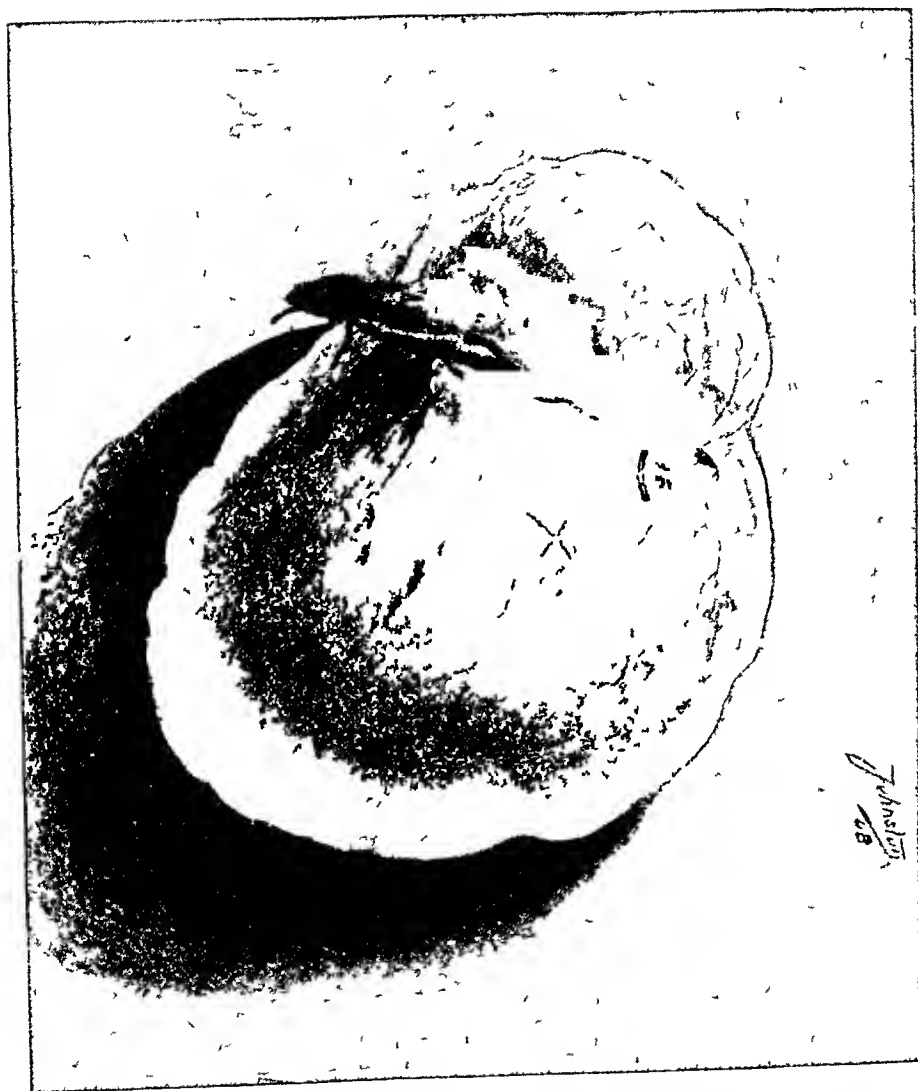
The diagnosis of hydrocele of the round ligament was made

FIG 1



Thrombus of spermatic vein Sac below (Case 5)

FIG 2



Bilocular cyst of round ligament Thrombus Larger part of sac intrapanetal (Case 6)

The operation was performed on February 19, 1901. The sac was easily exposed and appeared lobulated by reason of its constriction at the ring. The labial portion of the sac was easily enucleated. The intra-parietal portion, however, was deeply adherent to the parietal peritoneum from which, however, it was dissected without wounding the latter. Its firmest connection was with the round ligament where a firm reddish cord, still seen in the specimen, may have been what remained of the thrombosed vein (Fig 2). After the operation, the cyst which appeared bilocular before, was shown to be unilocular. It was very thin walled and evidently of the round ligament. The operation was concluded as an ordinary hernia.

That the obstruction and thrombus formation is oftener in an omental vein than the spermatic is evident from the relative frequency with which cysts are found in connection with irreducible hernias. A mass of omentum adherent at the neck of the sac, or an obstructed appendix will not infrequently be found associated with the separation of a part of the hernial sac from the larger portion above and the effusion into it of a serous liquid. What comes on in a rapid way in a strangulated omental hernia during the first few hours is of slow development in these chronic cases. In the latter there is never any admixture of the fluid with blood. Quite recently I saw a young man with a hernia which had been retained by a truss. A few weeks before he came for observation a rather large swelling formed just without the external ring. It was as large as the end of the thumb, smooth in outline and ovoid in shape. It was distinctly translucent and irreducible. In the inguinal canal there could be felt an irregular mass seemingly a protruded fold of omentum which had become adherent.

In contradistinction to these cases of cysts of the inguinal canal and of the upper portion of the spermatic cord, which in my judgment are the result of either venous obstruction or of thrombosis, are the cases in which the history of trauma or of a pre- or co-existing hernia cannot be obtained. These are cases in which the cysts of the spermatic cord or of the round liga-

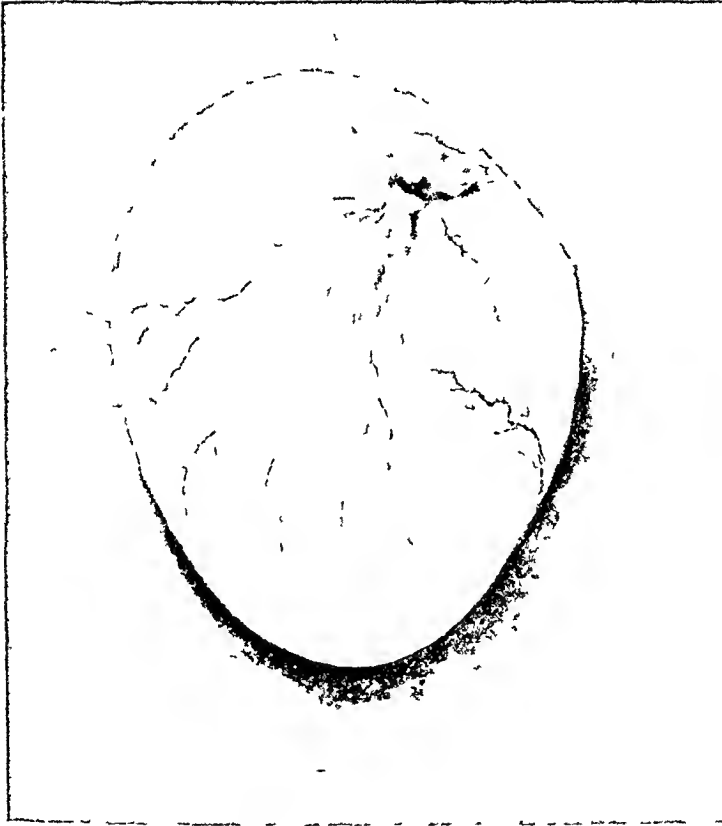
ment develop quickly, and at times with symptoms violent enough to suggest a hernial strangulation

An analysis of the cases which have come under my observation and of which I have four specimens, shows them to be thin walled, lined with a flattened epithelium and containing a clear fluid, characteristic of the ordinary hydrocele (Fig 3) The question arises whether in cases of ordinary hydrocele of the cord anything else can enter as an etiological factor than the embryonic rests of the vaginal process from the peritoneum through which the testicle descends or the round ligament passes

So far as I know, the theory that these cysts may be overgrowths from vestiges of the Wolffian bodies, has nothing to support it It is questionable, too, whether a hydrocele can occur in the cellular tissue of the cord or of the round ligament, without any preexisting virtual cavity such as a partly obliterated vaginal process In women particularly it has been questioned whether a hydrocele of the canal of Nuck is an anatomical possibility The studies of a number of German anatomists seem to have established the existence of such a process Although its patulousness is far less common than it is in male children, Bergmann found it open along its entire length in five and partly so in twelve subjects between one month and three years old Furthermore, it is unusual for cysts, except as a result of trauma, to develop in cellular tissue The analagon of a hydrocele in the neck is nearly always a branchial cyst Cysts in the inguinal canal, unless formed in a sequestered portion of the sac of a hernia, with or without thrombosis as an etiological factor, are practically always the result of an exudation into the preexisting unobliterated portion of the vaginal process That most of these cases occur in the young is explained on this basis That it may occur in the old is shown by the following case

CASE VII—D L, male, aged 61, was well until a year ago when there appeared a swelling in the right inguinal region With ordinary symptoms of a reducible hernia there gradually

FIG 3



Simple cyst of the spermatic cord (Scrotal)

FIG 4



Conglomerate inguinal cyst of the spermatic cord (Case 7)

developed an irregular growth in the inguinal canal and projecting into the scrotum. For about six months before the patient came under my observation the mass had become irreducible.

Physical Examination—Very well preserved and rugged man without other blemish than the local condition referred to. Occupying the region of the inguinal canal and the upper part of the scrotum there is an irregular mass elastic to the touch and presenting a distinct impulse on coughing. It was entirely irreducible. Because of the ease with which the mass was shown to be translucent, the diagnosis of hydrocele of the cord was made. The operation at the Good Samaritan Hospital March 28, 1898, revealed a cyst conglomerate extending within the abdominal cavity and pushing the peritoneum before it (Fig 4). The individual cysts varied in size from a peach to a bean, but did not communicate with each other. They were filled with a particularly clear fluid and were lined with the flattened endothelium of serous sacs. The operation was completed as an ordinary hernia.

It is impossible to state what, without the history of an injury, could have caused an effusion into these embryonic peritoneal rests after more than sixty years of an innoxious desuetude. A case has been recorded by Cenas (quoted by Broca) in which during an attack of acute articular rheumatism a hydrocele of the spermatic cord developed which completely subsided with the disappearance of the general infection. My patient did not have rheumatism.

It is rather difficult to account for the multilocular development of the cyst in the case presented. It is not unlikely that vestiges of the vaginal process, irregularly distributed along the cord, developed simultaneously into separate cysts without communicating with each other or with the general peritoneal cavity. It is characteristic of a true hydrocele of the spermatic cord that it has not any communication with the peritoneal cavity in contradistinction to the open hydrocele, which rapidly or slowly may empty itself into the abdomen and disappears. A seeming reduction of the tumor into the abdomen may take place in the true hydrocele of the cord or round

ligament, when as in case six a large portion of the cyst is above the internal ring and yet on the outside of the peritoneum between it and the muscular portion of the abdominal wall in front. These are the so-called bilocular hydroceles, a part of which appears in the labium or the upper portion of the scrotum and the other portion above the internal ring, and yet separated from the abdominal cavity by an intact peritoneum. It appears that in these cases by the upward growth of the true cyst, the parietal peritoneum is dissected away from the anterior wall in front much as it is in the intra-parietal forms of hernia. Indeed, in many of the cases of bilocular hydrocele hitherto recorded, there has been found, as in properitoneal hernias, some anomaly of position of the testicle. Diverticula of the vaginal process added to the great mobility and ease of displacement of the peritoneum about the internal ring, will readily account for the disappearance of the bilocular inguinal hydrocele. Its appearance during early life and in the young supports the view that in many cases there is an anatomical congenital anomaly as a basic factor.

In the above considerations, cysts of the lower part of the cord and those in conjunction with the testicle have not been considered. Like the organ of Giraldes, an embryonal rest of the Wolffian body, cysts may develop in connection with the upper part of the epididymis from this structure. They never, however, extend to the inguinal canal and are closely fixed to the testicle.

Nor has more than reference been made to the cysts of the inguinal canal and the upper part of the scrotum, which are due to the sequestration of a portion of a hernial sac and the accumulation within it of a serous transudate. The condition of a hydrocele in a part of a hernial sac is often enough encountered and thoroughly understood.

The diagnosis of thrombosis and of hydrocele of the cord within the inguinal canal and projecting beyond the external ring ought under ordinary circumstances present no difficulties. In the cases of thrombosis above described the diagnosis was easily made, and in the hydroceles which followed or developed

without preexisting thrombosis, the light test sufficed to clear up any doubt which might have existed. Nevertheless, thrombosis of the spermatic veins and an acute hydrocele may set on with such severity of symptoms as to simulate almost in every particular a strangulated hernia. In exceptional cases too, a differential diagnosis between thrombosis of the cord and thrombosis of an omental protrusion cannot be positively made until the parts are exposed by operation. Fortunately in either event an error in diagnosis would only accrue to the benefit of the patient in that an early operation would be insisted upon and probably performed.

The treatment of the conditions under consideration is simple enough. In the milder cases of thrombosis, expectant treatment is indicated. In those of larger dimensions following a trauma or in which from the size of an hematocele a positive diagnosis from hernia cannot be made, an operation is indicated. In hydroceles the older methods of aspiration and of injection have been rightly discarded. Complete excision of the sac is the only advisable procedure. Although in a considerable proportion of cases (as in the bilocular) the enucleation would involve the properitoneal space, the operation does not present insurmountable difficulties. In hydroceles resulting from sequestration of a portion of the sac, the operative treatment is that of an ordinary hernia. It is almost needless to conclude with the injunction that the operation, when complete, must leave the inguinal segment of the abdominal wall as competent to resist pressure as after the ordinary hernia operation.

COMPARATIVE VALUE OF VARIOUS MEASURES FOR RELIEF OF PROSTATIC ENLARGEMENT

BY AUGUST SCHACHNER, M D ,
OF LOUISVILLE, KENTUCKY

IN the pathology of prostatic enlargement, there is usually not enough stress laid upon the trophic changes that occur in the bladder. These changes, the result of the disturbance of the circulation from the bladder, are occasioned by the compression of the valveless vesico-prostatic veins through the increasing growth of the prostatic gland. Usually the attention is directed, almost if not entirely, to the obstructive disturbance exerted upon the urinary outflow. As the result of this venous disturbance the muscular coat acquires connective tissue at the expense of muscular fibres, thereby impairing the contractility and expulsive power of the bladder. Due to this disturbance the bladder, with its impaired tonicity when filled with urine, sags into the pelvis while the neck is firmly held against the pubes by the pubo-prostatic ligaments, in this way forming a retro-prostatic pouch which acts as a reservoir for the residual urine. We have also the formation of trabeculae and between the trabeculae, sacculation through the yielding of the bladder wall. The mucosa by its impaired resistance becomes more sensitive, more susceptible to inflammatory changes as evidenced by the frequent urination.

In the treatment, much depends upon, first, the care with which these cases are selected and prepared for operation, secondly, the rapidity and ease with which they are operated upon, *i e*, the shortest time, the least exposure, the most careful manipulation, and the minimum amount of hemorrhage, lastly, the carefulness and gentleness with which these patients are nursed. Old and more or less decrepit, they make constant demands upon the nurse, who is able to influence, not alone the ultimate outcome of the case, but to aid the early convalescence

as well as adding immeasurably to the comfort of the patients during their illness

The operative procedures for the relief of this condition have been narrowed practically to prostatotomy or the Bottini operation, and to prostatectomy

$$\text{Prostatectomy} \left\{ \begin{array}{l} \text{Suprapubic} \\ \text{Perineal} \end{array} \right. \left\{ \begin{array}{l} \text{Blind enucleation} \\ \text{Open dissection} \end{array} \right.$$

Prostatotomy, or the Bottini operation, has played an important rôle in the development of prostatic surgery, and is still an eligible procedure in the extremely old, or especially those afflicted with some serious cardiac, renal, or other underlying trouble, making them undesirable subjects and justifying a temporizing operation. It is the opinion of some surgeons that aside from the cases just indicated it is frequently a desirable procedure in the small, hard, fibrous prostate, which is always difficult of removal, and which, if removal is attempted, should if possible be by the perineal route with an open dissection.

The objections to it as a procedure of general employment are that the incisions made by the cautery are uncertain as to their depth, location or influence upon the gland, and dealing only with the obstruction to the urinary flow, leave untouched that which is equally if not more important, namely, the interference with the venous drainage of the bladder wall. Lastly, as applied to the general class of cases, its mortality is hardly equal to perineal enucleation, which aims at the whole trouble.

The most urgent question in connection with this subject, however, is the choice between the suprapubic and the perineal method. While the most ardent devotee usually concedes that there is a place for the opposite method to the one he espouses, there is frequently hardly enough of this concession. It would be better if there existed a greater desire to see the good in

the other side rather than be blindly absorbed in the advantages of the method elected. However attractive the arguments in favor of one method as opposed to the other may be, the verdict in the end must be determined by the mortality. The surgeon who ignores this, at once assumes the burden of proving that mortality in surgery is but of secondary importance, and of demonstrating why the so-called best operation which he espouses has a higher mortality than the operation which he renounces as not as good.

Statistics can be arranged from many angles, but when we arrange the results of the best operators of the different methods we believe that such statistics represent a fair presentation of the case, especially, when the different statistics of the different investigators are practically harmonious.

The following statistics by Watson (Francis S. Watson, *Operations for Prostatic Hypertrophy*, *ANNALS OF SURGERY*, vol. 39, p. 855) represent the mortalities of the two methods in the early portion of the recent period of prostatic surgery.

PERINEAL TOTAL REMOVAL			
	Cases	Death	Mortality
Goodfellow	74	2	
Albarran	59	2	
Proust	30	0	
Pauchet	20	1	
Rafin	20	1	
	<hr/>	<hr/>	
	203	6	2.9 per cent

SUPRAPUBIC			
	Cases	Death	Mortality
Freyer	45	5	
Moynihan	12	1	
Mayo Robson	12	0	
	<hr/>	<hr/>	
	69	6	8.6 per cent

According to Cunningham (John H. Cunningham, Jr., *Boston Medical & Surgical Journal*, No. 19, 1907, p. 602) the mortalities of the existing methods for the treatment of senile hypertrophy of the prostate are

	Cases	Per Cent Mortality
Catheterization	207	77
Palliative operations	168	369
Partial prostatectomies	167	191
Bottini operations	1289	53
Total suprapubic prostatectomy	406	96
Total perineal prostatectomy—		
1 Dissecting	563	55
2 Enucleation	192	47

The following collection of cases is illustrative of suprapubic mortality.

	Cases	Per Cent Mortality
Proust	224	120
Watson	263	133
Escart	164	180
Terney & Chase	396	98
Freyer	205	73

Following is a list of the most recently reported cases of the perineal dissecting operations with their accompanying mortalities

	Cases	Per Cent Mortality
Young	150	46
Ferguson	103	36
Albarran	73	40
Hartman	56	90
Pauchet	53	70
Legneu	45	88
Murphy	51	39
Rafin	32	62
Total number of cases	563	
Average mortality		55

MEDIAN PERINEAL PROSTATECTOMY—BLIND ENUCLEATION

	Cases	Per Cent Mortality
Syms	34	56
Watson	54	80
Goodfellow	78	25
Cunningham	24	00
Total number of cases	190	
Average mortality		47

Freyer (British Medical Journal, Oct 5, 1907) reports 432 suprapubic operations, with 29 deaths, or a mortality of 7 per cent

Zuckerkandel (Wiener klinische Wochenschrift, No 40, p 1200) reports 60 prostatectomies, 30 by the perineal method, with a mortality of 4 per cent and 30 by the suprapubic, with a mortality of 7 per cent This same author has noticed a condition of anesthesia in the posterior urethra that existed in patients after a perineal operation that did not exist after suprapubic operation, showing a nerve injury in the perineal operation that does not occur in the suprapubic

The statistics are harmonious throughout, namely, that the perineal operation is almost twice as safe as the suprapubic The other difference noted in studying these statistics is a difference in the mortality between operators of the same class, *i e*, different operators doing the suprapubic operation and different operators doing the perineal

The difference in the mortalities of operators of the same class can be explained on the basis of personal equation, more experience, and lastly, the more careful selection of cases and operative conditions, the latter as proper up to a certain point as it is improper beyond that point A low mortality is sometimes acquired by denying certain cases the right of surgical relief because their outlook is not promising The statistics of Cunningham, which indicate a mortality of 5.5 per cent where the operation consists of the open perineal methods, compared with the more favorable mortality of 4.7 per cent where the blind enucleation is practiced, are significant in demonstrating that the simpler and quicker the operation is performed the lower will be the mortality There are many surgeons who have yet to be convinced that the suprapubic is simpler than the perineal That less important structures are divided, that less hemorrhage is encountered, that less injury to the bladder is sustained, that drainage is better, convalescence shorter and fistulæ rarer in the suprapubic than in the perineal We are inclined to suspect that the reverse is true even though trustworthy men have done the suprapubic

enucleation in two minutes or less whatever that may mean and we further suspect that because the reverse is true the mortality is higher.

There has been a difference of opinion among the operators favoring the perineal method as to whether the gland should be removed by blind enucleation or through an open dissection. Those favoring the open dissection contend that the blind enucleation is opposed to well-grounded surgical principles in that the work is done in the dark, and that by this method there is a needless sacrifice of the ejaculatory ducts.

It would seem that this question would depend more upon the age and vigor of the patient than upon the two objections just enumerated. While good exposure of the operative field is a well-grounded principle in surgery, experience proves that the advantages gained by the free exposure are offset by a higher mortality which can only be explained on the ground of more time, exposure and manipulation. Furthermore, results prove that exposure to ocular inspection is not necessary to obtain satisfactory results.

As to the second objection, the needless sacrifice of the ducts, we might with justice speak of this as making, in the majority of instances, "the most out of the least," particularly where the subject is an old one. Blindly enucleating the gland does not necessarily mean the destruction of the ducts, any more than open dissection necessarily means the conservation of the ducts, although we are always prepared to lose them in the blind method, and expect to save them by the open dissection. The potency which these subjects as a rule possess is at a very low ebb, if it exists at all, and if we preserve this, which we admit should be attempted in the younger class of cases, it must be remembered that the subject is expected to be sterile if a total enucleation of the gland is carried out, and the teaching of the functions of the prostatic secretion is accepted.

The chief factors in the mortality are uraemia or renal insufficiency, sepsis, shock, and post-operative and pulmonary complications which Watson arranges in frequency as follows.

	Per Cent	
Bottini	270	" "
Perineal operations	350	" "
Suprapubic "	340	" "
		} Uremia (or renal insufficiency)
Bottini	520	" "
Perineal operations	178	" "
Suprapubic "	86	" "
		} Sepsis
Bottini	50	" "
Perineal operations	214	" "
Suprapubic "	300	" "
		} Shock
Bottini	80	" "
Perineal operations	178	" "
Suprapubic "	220	" "
		} Post-operative pulmonary complications

There is scarcely any difference in the degree of danger between the perineal and the suprapubic operations so far as uraemia or renal insufficiency goes, and not a very great difference between these two and the Bottini operation. As to sepsis the mortality is about seven times greater in the Bottini than it is in the suprapubic, and about twice as great in the perineal as it is in the suprapubic. This can be explained by the better drainage, not so far as the urinary element is concerned, as better drainage of the secretions accumulating in the cavity from which the prostate has been enucleated.

Deaver (in the *Pennsylvania Medical Journal*, No 11, v 10) says "The prostate lies upon the triangular ligament and above the aponeurosis of Denonvilliers, neither of these structures so important in completing the floor of the pelvis, is divided when the prostate is lifted off them and delivered into the cavity of the bladder. This explains the difference in the percentage of sepsis in the three procedures, and to a large extent likewise explains some of the better end results through the suprapubic method, such as less disturbance of the control."

As to the question of shock, these tables show 5 per cent for the Bottini, 21.4 per cent for the perineal and 30 per cent for the suprapubic, pointing unmistakably to the operation having the most and the least operative interference.

Under the head of post-operative complications we have

8 per cent for the Bottini, 17.8 per cent for the perineal and 22 per cent. for the suprapubic. These figures are readily explained on the basis of the Bottini requiring little or no time in bed and the suprapubic requiring the longest time and consequently attended with the highest per cent. of post-operative complications.

The ease and rapidity with which the prostate can be enucleated by either the suprapubic or perineal method has been a strong temptation to its total removal at one sitting and thereby remove the offending member. We believe with Chetwood, Cabot and others that there are some cases that could be more successfully handled if dealt with in two stages. In extremely old and feeble, or where the bladder condition is unsatisfactory, a preliminary cystotomy followed in ten days or two weeks by enucleation will be attended with more successful results than if dealt with by one move as Cabot (*Boston Medical & Surgical Journal*, Oct. 24, 1907, p. 556) very tersely suggests, "if the preliminary cystotomy kills, a prostatectomy would have been foolhardy. If the patient recovers from the little blow, he usually rapidly gains strength, the prostate becomes less congested, the cystitis disappears and we have procured a change which usually permits a successful enucleation later."

CONTRIBUTION TO THE SURGERY OF THE PROSTATE.*

THE RESTORATION OF VOLUNTARY CONTROL OF THE URO-GENITAL SPHINCTER
IN CASES OF INCONTINENCE OF URINE FOLLOWING OPERATIONS UPON
THE PROSTATE BY AN OPERATIVE DEVICE IN THE TREAT-
MENT OF URETHRO-RECTAL FISTULÆ

BY SAMUEL ALEXANDER, M D.,

OF NEW YORK,

Professor of Clinical Surgery, Department of Diseases of the Urinary Organs,
Cornell University Medical College, Attending Surgeon,
Bellevue Hospital

THE mechanism of the urinary incontinence which occurs sometimes after operations upon the prostate is imperfectly understood. This is very largely the result of ignorance of the physiological mechanism which presides over urination. An examination of the various standard works upon medicine and surgery sheds little light upon this subject, but rather adds to the difficulty, owing to the conflicting statements made therein without adequate explanation.

I question very much whether it is possible from our present knowledge to write a strictly accurate description of the complex physiology of the urinary act. It is certain, however, that much of the confusion which now exists can be removed.

I have endeavored in another place to give as clear a description of the physiology of urination as our knowledge of this complex process permits. I purpose in this paper to present some observations in regard to the cause of certain forms of incontinence of urine and to describe a method of treatment which I have employed for its relief and which I think has not heretofore been suggested.

The class of cases to which I desire to call attention are those in which there is a more or less complete inability to

* Read at the Annual Meeting of the American Association of Genito-Urinary Surgeons at Hot Springs, Va., May 1, 1908

retain urine in the bladder owing to partial destruction of the urogenital sphincter, or of its attachments, caused by surgical operation

During recent years the popularity of prostatectomy in the treatment of obstructive prostatic disease, and the prevailing belief that any surgeon, no matter how limited his experience or knowledge, may perform these operations, has multiplied these cases manifold. I say this advisedly because during the past three years more cases of this kind have been admitted into the service under my charge at Bellevue Hospital than heretofore.

These patients were operated upon in other hospitals, and as a result of the manner in which the operations were performed, their condition was made worse, and ultimately they were transferred to Bellevue Hospital. Many of them according to popular standards could be classed only among the hopelessly incurable.

In some of these cases the obstructing portion of the prostate had been only partially removed, and sufficient obstruction remained to require a second operation for its removal. In other cases the anterior wall of the rectum had been torn and there were at the time of their admission to the hospital large urethrorectal fistulæ. The perineum in these latter cases was little more than scar tissue owing to ineffectual attempts to repair the damage.

In most of these cases there was a more or less constant leakage of urine either into the rectum or through the perineal fistulæ which remained open, or through both. In other cases, although the prostate had been removed, so much damage had been done to the urogenital sphincter that there was more or less constant dribbling of urine through the urethra.

As most of these patients were advanced in years, weakened physically by disease, and by a prolonged convalescence after serious surgical operations, the prospect of any ameliora-

tion of their symptoms seemed remote The treatment of these cases, however, was undertaken, with a determination to spare no time or pains to accomplish a cure

We may for convenience divide these cases of incontinence into two classes, viz

a Those complicated by urethrorectal fistula

b Those not complicated by urethrorectal fistula

The cause of the urinary incontinence in all of these and similar cases is, I believe, due to more or less destruction of the fibres of the urogenital sphincter muscle, or to a malposition of the attachment of the fibres of parts of this muscle so that they can act only at a disadvantage The coordinate action and reaction which normally exists between the intrinsic muscle of the bladder and the sphincter is therefore disturbed It will be found that incontinence of urine occurs most frequently when the roof of the prostatic urethra and with it the arch which the urogenital sphincter forms in front of the canal is damaged It occurs also more frequently in those individuals who have naturally a more or less atonic muscular mechanism

The principle of treatment is

1 To restore when necessary the perineum, the rectal wall and the urethra to a condition as nearly approaching the normal as possible

2 To teach the individual by exercise, to use what remains to him of the urogenital sphincter muscle, so that he may acquire voluntary control over the retention and expulsion of urine

When the control of urination by voluntary effort is attained, automatic control will follow as a physiological necessity

Any atonic or damaged muscle may be made to act, and the power of its action gradually increased by proper exercises

It is the method of application of these principles of physiology to the act of urination that constitutes the virtue of our treatment.

THE OPERATIVE TREATMENT OF URETHRORECTAL FISTULÆ

The closure of urethrorectal fistulæ is looked upon as one of the most uncertain and unsatisfactory of operative procedures. The difficulty of keeping the line of sutures free from infection and of effectively draining the bladder, make a failure of these operations the rule rather than the exception. It is therefore a satisfaction to be able to report that I have so far overcome the difficulties formerly encountered, that I have been able to close these fistulæ permanently by a single operation, and by methods which while they require experience and careful nursing, can be successfully employed by any competent surgeon.

It is necessary in these cases of urethrorectal fistula following prostatectomy to determine first, whether all obstructing portions of the prostate, especially all intravesical projections, have been removed, and whether the bladder is free from calculi. I mention these facts because I have met with cases in which not only was the prostatectomy incomplete, but in which calculi, and in some instances encysted calculi were found in the bladder.

When these conditions are present they should be removed, and the prostatic urethra and vesical orifice should be made even and smooth to the touch before an attempt is made to close the urethrorectal fistula.

To close the fistula the patient is prepared by a few days' purgation with castor oil and the bowel is washed out thoroughly at the time of operation.

With the patient in the lithotomy position a curved incision is made in the perineum in front of the anus, extending from one tuberosity of the ischium to the other, the central portion of the perineum is divided and the dissection is carried upward between the rectum and the prostate so as to expose the wall of the rectum externally for at least $\frac{1}{2}$ inch above the upper margin of the fistula.

This dissection is to an inexperienced surgeon difficult; for after the prostate has been removed the tissues are very

thin between the rectum and the urethra. It will be found that more space in the perineal wound can be obtained by dividing the origin of the transversus perinei muscles from the ischium, or at least the more superficial part of these muscles.

The edges of the fistula should be separated from the urethra by cutting with a sharp knife and scissors and not by blunt dissection. The edges of the urethra at the seat of the fistula should be carefully refreshed by cutting away all overgrowing mucous membrane from the urethra, but the urethra should not be sutured.

The tissues about the fistulous opening in the rectal wall are then refreshed with curved scissors and made smooth. All hemorrhage should be stopped and the wound made as dry as possible. The opening in the rectal wall is then closed by interrupted Lembert sutures of chromicized catgut placed from the perineal side by means of a round curved needle. These sutures should not include the mucous membrane of the bowel. One suture should be placed well above the upper margin of the opening and one well below the lower margin. It will be found convenient to introduce the sutures from below upward, and not to tie any suture until all have been placed.

After the opening into the rectum has been closed the bladder and bowel are to be irrigated by means of a metal tube. During this process the bowel should not be distended. No drainage tube is put into the bladder.

To protect the line of suture in the rectal wall I have devised the following expedient. A small triangle of gauze consisting of six or eight layers is made to fit the wound. The apex of this triangle is carried by forceps up to and behind the vesical orifice. Between the layers of gauze, a 10 per cent iodoform ointment, made with vaseline, is then injected from a glass syringe and the little pad is then plastered down so as to fit the posterior surface of the perineal wound accurately.

As the urine flows from the bladder over this pad it is shed off this as water is from a duck's back.

The gauze is to be changed twice or three times a day, or oftener if the pad becomes displaced

The external wound is then dressed by gauze pads to absorb the urine as it flows out of the wound

I have usually confined the bowels by the use of opium for one week, and have then given a dose of castor oil and have superintended the giving of an enema at the time of the first movement

On each day during the first week I introduce into the rectum a metal tube and wash out the lower bowel without distending it, and then inject into the rectum about one or two drachms of iodoform ointment I am now able uniformly to get solid union of these fistulæ It requires, however, attention to minute details and good nursing and careful watching The results are a full compensation for the work

The perineal wound is given the most careful attention during cicatrization so that it will fill in from the bottom without fistula Sounds are passed after the first ten days as they may be required to keep the urethra free from stricture and to make its walls smooth

THE RESTORATION OF VOLUNTARY CONTROL OF THE UROGENITAL SPHINCTER

After restoration of the rectal wall and of the perineum these cases of urinary incontinence come into the second division of our classification and are to be treated as the cases of incontinence not complicated by urethrorectal fistula

Every surgeon who has had extensive experience in the performance of prostatectomy has encountered these cases, and the occurrence of this disability has frequently been presented as an argument against the operation Happily the great majority of cases of prostatectomy skilfully done do not suffer from this disability But there is a sufficiently large number that do so suffer and so far as I know no adequate method of treatment has heretofore been suggested

The method which I now present has had an extensive

trial during more than three years and the results which have been obtained have justified our most sanguine expectations

I had the honor to show to the Society of Clinical Surgery at their meeting in New York last October a large number of the cases which form the basis of this paper, and give a practical demonstration of the method of treatment by which these patients had been cured

This inability to retain the urine as I have said may be more or less complete and I have seen the following different degrees

- 1 There may be what is practically if not literally a complete incontinence The action of the urogenital sphincter seems to be abolished and the urine almost as fast as it flows from the ureters into the bladder, flows out through the urethra, drop by drop The flow is usually intermittent, and corresponds to the intermittent flow from the ureters

- 2 The bladder may be able to retain a small quantity of urine, but when this amount is exceeded there is leakage

- 3 The leakage may be intermittent, occurring at certain times during the day There is often no leakage during sleep, nor for several hours after rising in the morning, but toward evening when the patient becomes physically tired, there is more or less incontinence

- 4 The patient may have perfect control while sitting or lying down, but when standing or walking, there is involuntary leakage

- 5 There may be leakage immediately after the urinary act, caused by retained urine in the urethra as the result of an atonic condition of the urethral walls

These different degrees of disability are subject to infinite variation

The effect of this inability to retain the urine, upon the minds of men naturally feeble, or made feeble by sickness and by disappointment, is often lamentable And it is very necessary to arouse in the minds of these patients the hope that their disability is not a permanent one The influence of suggestion here is undoubtedly great, and no time or pains should

be spared to impress them with the reasonableness of a promise to cure them. This is essential, because without the hearty and intelligent cooperation of the individual patient a cure is impossible. On this account and to accomplish the best results, I have adopted the plan of treating several patients together in the hospital, so that those who are beginning to be taught to gain urinary control may be encouraged by those who have been taught, or who are at least further advanced toward a cure than they themselves are.

The method of instruction must vary with each case, but a general idea of the plan pursued in most cases may be given in outline.

The principle of treatment is to make the individual learn by practice to exercise voluntary control over what remains of the urogenital sphincter, thus to prevent the escape of urine. If this can be done, automatic control follows as a physiological necessity.

The difficulties to be overcome are greater than they might at first seem because in some of these cases there has been a very extensive destruction of the urogenital sphincter, by the improper performance of the prostatectomy. Yet even in the seemingly hopeless cases it is surprising to find how readily the parts remaining of this complex muscular mechanism which we call the urogenital sphincter may be trained to compensatory work.

The first step in accomplishing this result is to accustom the individual to moderate bladder distention. A catheter is introduced through the urethra and a warm saline solution is injected. The quantity injected should be just short of that sufficient to excite vesical contraction and a desire to pass urine. The catheter is then closed by the finger and the individual is instructed and urged to exert himself to retain his urine, this is continued for several minutes, then continuing to urge the patient to "hold his water" the catheter is withdrawn. The fluid from this bladder is usually at first expelled, but the patient is urged during the entire time to prevent its escape.

This procedure is repeated several times and with varying quantities of fluid

After a few days it will be found that the ability to retain some of the fluid injected is acquired. This fact should be pointed out to the patient and he should be encouraged in his efforts. He should be instructed to make voluntary effort to control the escape of urine whenever he can.

After he has acquired the ability to control the injected fluid in the recumbent position, he is taught to control it when moving, when getting out of bed, when sitting down and when performing certain mild calisthenic exercises, as raising first one foot, then the other foot, sitting down and then arising. These actions are at first done with deliberation, then more rapidly.

In order to prevent leakage it is important to see that the urethra is completely emptied after each act of urination. In old men whose muscular structures are relaxed, or in whom the accelerator urinæ muscle has been injured the urethra does not empty itself and the presence of urine in the canal excites the contractility of the bladder and causes dribbling of urine. The patient is instructed to press upon the perineum with the fingers and to strip the urethra after each act of urination.

As soon as he has acquired any voluntary control, he should be instructed to urinate at frequent intervals and each act of urination should consist of an exercise of interrupted urination, viz, to begin the act, to cut off the flow, to begin again, to control the flow.

At first all of these exercises must be done under supervision, and the rapidity with which the results are obtained will depend in a measure upon the intelligence of the individual and his cooperation in the treatment. An ignorant, discouraged, sulky old man is hard to teach, but it can be done if one gives the time and energy necessary.

MUSCULO-SPIRAL (RADIAL) PARALYSIS DUE TO DISLOCATIONS OF THE HEAD OF THE RADIUS.

WITH ESPECIAL REFERENCE TO THOSE CASES COMPLICATING FRACTURE
OF NEW YORK,

BY DE WITT STETTEN, M D,

OF NEW YORK

Assistant Visiting Surgeon to the German Hospital

THE question of injury to the musculo-spiral nerve, perhaps the most frequently affected nerve in the body, has been treated exhaustively in the medical literature, but that particular form due to dislocations of the radial head has been surprisingly neglected. The scant respect shown this important combined lesion which represents a distinct pathological and clinical entity, its comparative frequency and practical significance, and the possibility of a completely successful surgical treatment of the condition have induced the writer to report, in detail, the following case which first came under his observation while he was house-surgeon at the German Hospital, New York. In connection with this report, he has reviewed the literature of the subject, laying particular stress upon those cases complicating fracture of the ulna, and finally, he has made a number of cadaver experiments to determine the anatomical relations of the dislocated radial head to the musculo-spiral nerve.

Patient F P, printer, aged 19. On August 12, 1903, while the patient was winding a cable of a theatre curtain, the crank slipped from his hand, reversed, and forcibly struck his right forearm. He was unable to use his arm, and a doctor made the diagnosis of fracture of the ulna. The patient states that shortly after the injury he noticed that he could not extend his wrist or fingers, and that the back of the hand and half of the fingers felt numb. The arm was put in a splint, which was worn for four weeks, and when this was removed there was decided impairment of the function of the elbow, while the condition of the

wrist, hand, and fingers was unchanged. These functional disturbances persisted until the patient's admission to the German Hospital, New York, on November 13, 1903, three months after the injury.

EXAMINATION—*Inspection* of the right forearm shows a depression on the ulnar side at the junction of the upper and middle third and a marked prominence on the radial side of the cubital fossa. There is a drop-wrist. The forearm is atrophied and the skin of the dorsum of the hand looks bluish and glossy.

Palpation reveals a distinct deformity of the ulna corresponding to the depression and caused by a bowing of the bone, forwards and radially. The fragments are firmly united, there is considerable callus at the point of fracture, the angle formed by the two fragments is about 160 degrees, the upper fragment is displaced inward and backward, the lower outward and forward. The prominence in the bend of the elbow is the radial head, resting on the lateral condyle of the humerus. It is slightly thickened. It rotates in pronation and supination. The dorsum of the hand is cold.

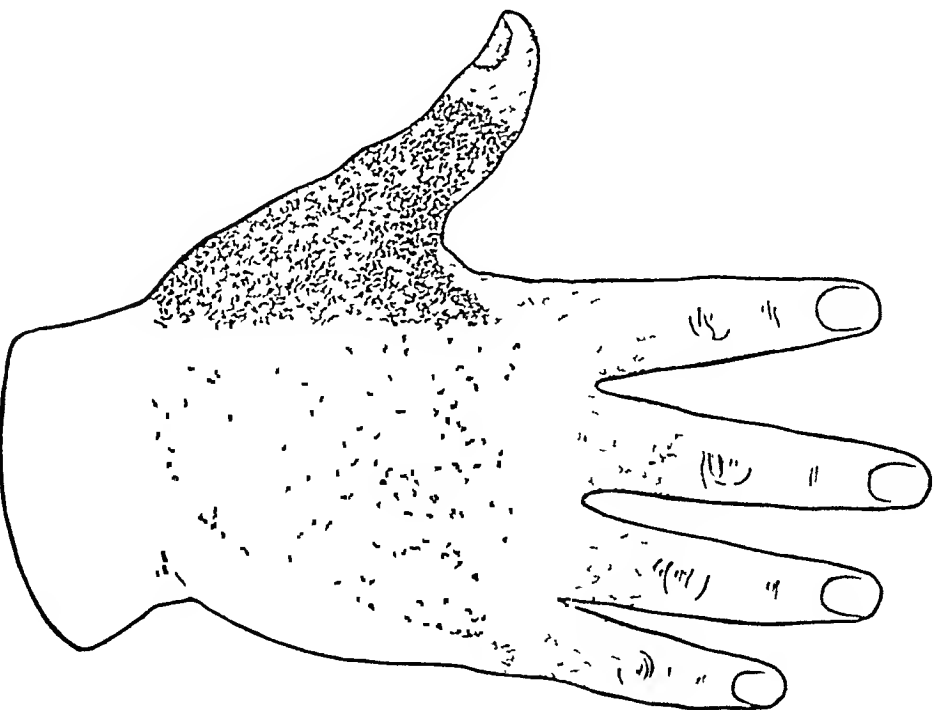
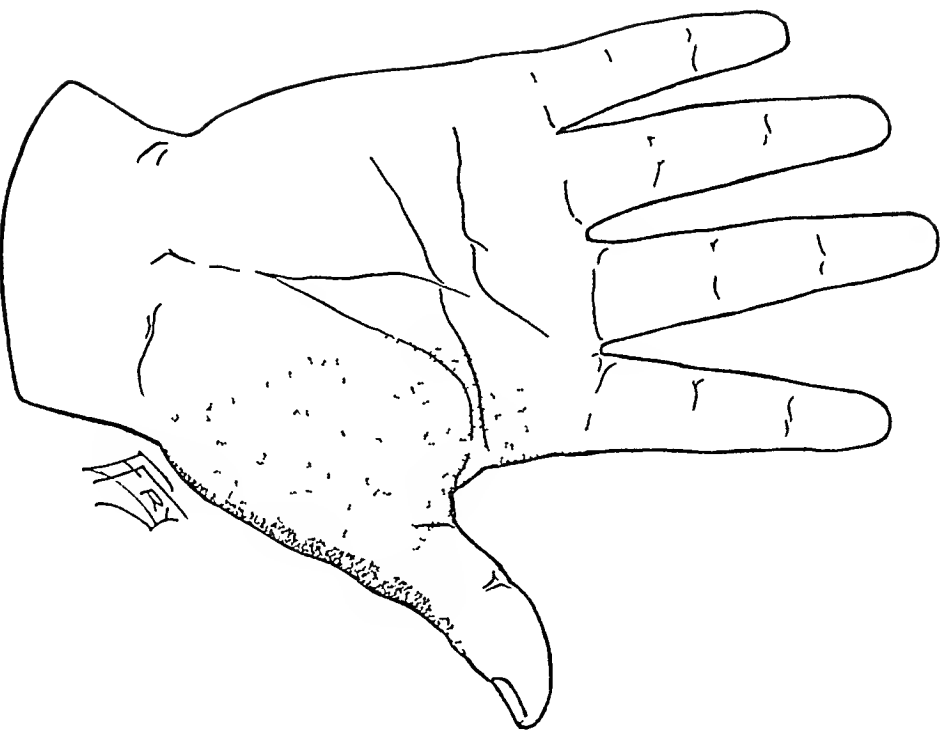
Active Motion At the Elbow—Flexion is limited to about 100 degrees. Extension is unaffected. Pronation and supination are somewhat restricted, particularly the latter.

At the Wrist—Flexion is normal. Extension is only possible for about 15 degrees from the drop-wrist position. Abduction is slightly limited. Adduction is not impaired.

At the Fingers—Flexion is normal. The proximal phalanges and the thumb cannot be, while the two distal phalanges of the four fingers can be extended. The abduction and adduction of the four fingers are normal, but the thumb cannot be abducted.

Passive Motion—Flexion, pronation, and supination at the elbow are limited to the same extent as the corresponding active motions. Forcing produces considerable pain. Extension of the elbow and all the movements of the wrist and fingers are passively uninterfered with. The patient's grip is weak, but is somewhat strengthened on passive extension of the wrist.

Sensation—There is practically a total loss of sensation of the entire dorsum of the hand which extends to the phalangeal joint of the thumb and almost to the metacarpophalangeal articulations of the fingers. This area of anaesthesia reaches nearly to



Areas of anesthesia Dark shading—practically total anesthesia Light shading—impaired sensation

FIG 2



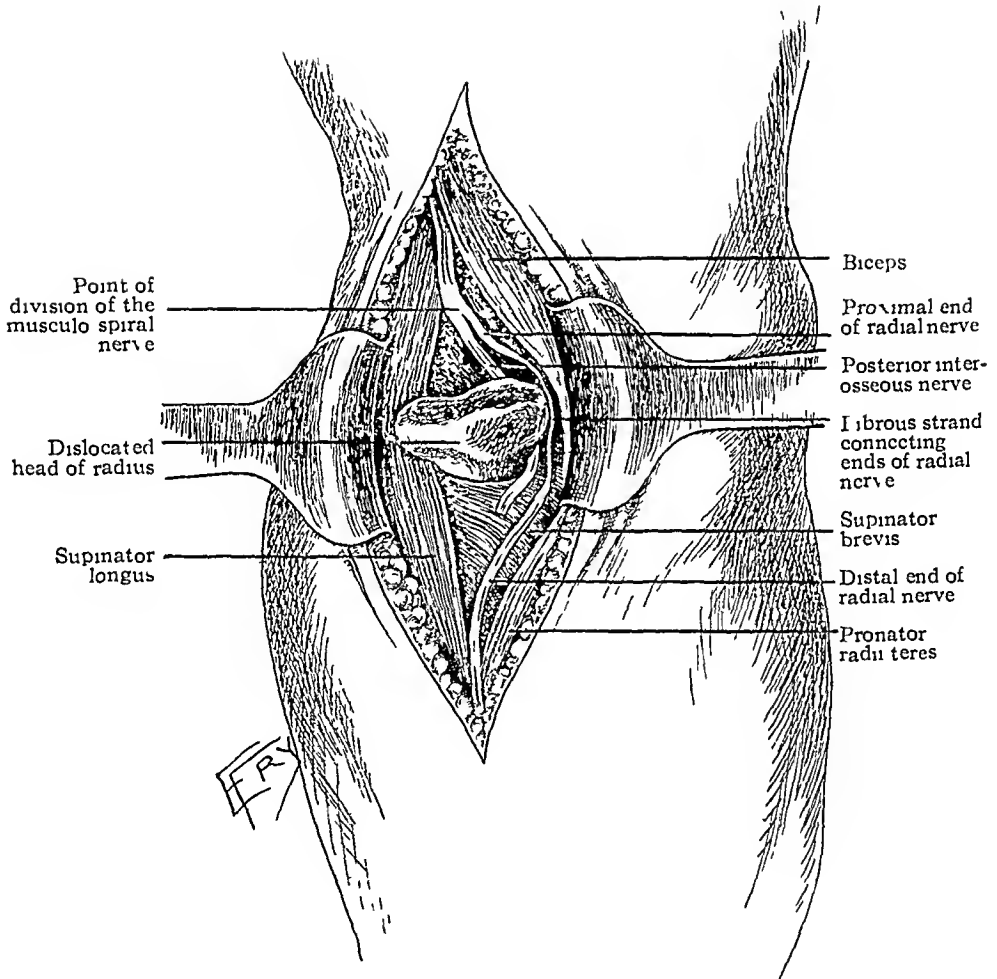
Skigram before operation Flexion Lateral

Fig 3



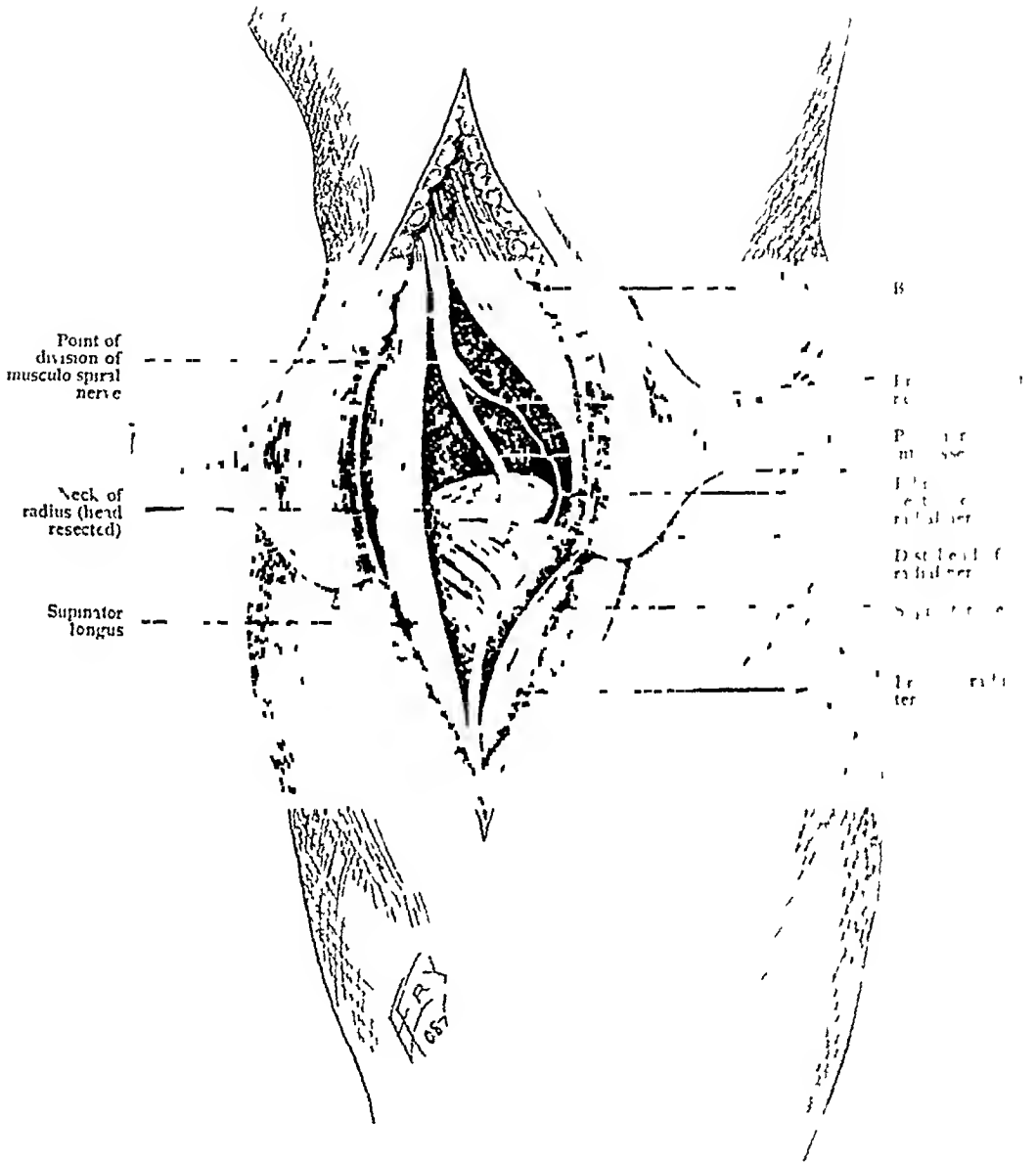
Shirgum before operation Intusion Anteroposterior

FIG 4



Condition at operation

FIG 5



Appearance after resection of head of radius

the wrist On the ulnar side of the back of the hand there is a narrow strip of normal sensation The dorsal surfaces of the distal phalanx of the thumb and the proximal phalanges of the fingers show impaired sensation, as does the thenar eminence (See Fig 1)

Electrical Reactions—There is a total loss of faradic contractility of the extensor communis on direct stimulation This muscle is more excitable to galvanism, and $A\ C\ C > K\ C\ C$ On stimulating the musculo-spiral nerve in the arm, the extensor communis reacts neither to faradism nor galvanism, but the extensor carpi radialis longior and the supinator longus react normally

Mensuration shows—

	Right	Left
Ulna—Styloid process to olecranon	24 cm	25.5 cm
Radius—Styloid process to epicondyle	26 cm	28 cm
Circumference of forearm 5 cm below olecranon	22 cm	24.5 cm

There is a shortening of the ulna of 1.5 cm and an apparent shortening of the radius of 2 cm The atrophy of the forearm is 2.5 cm

Radiographic examination shows a fracture of the ulna at the junction of the upper with the middle third and a dislocation of the head of the radius forward and slightly outward There is a moderate deformity of the fractured bone consisting in a bowing forward and outward, the lower fragment overriding the upper and lying internal to it There is bony union with a fair amount of callus (See Fig 2 and 3)

The diagnosis of the bone and joint lesion being evident, there still remained to be considered the exact nature and site of the nerve lesion, and what measures should be taken to increase the usefulness of the extremity There was no doubt that there existed a musculo-spiral paralysis, and it was finally decided that this was due to a contusion or a laceration of the nerve, probably produced by the dislocated radial head It was further concluded that the nerve was probably injured below its bifurcation into the posterior interosseous and radial as it was distinctly observed that the extensor carpi radialis longior, and especially the supinator longus, were not paralyzed These muscles are supplied before the nerve divides

The attempt at bloodless reduction of the old dislocation naturally failing, operation was decided upon with the following indications

- 1st To investigate and repair the nerve injury if possible
- 2nd To increase the flexion of the elbow by either reducing the dislocation or resecting the radial head

The *operation* was performed on November 19, 1903, by Dr F Kammerer

A 10 cm longitudinal incision was made directly over the prominent head of the radius. The supinator longus was exposed, and just medially was seen the protruding radial head which had pushed sharply inward the two divisions of the musculospiral nerve (See Fig 4). The head of the bone is somewhat hypertrophied and the cartilaginous surfaces are no longer glossy. Both branches of the nerve are much flattened, and the nerve fibres are apparently ruptured. It seems as if the ends are held together by thin, flat, fibrous strands, the remnants of the nerve sheaths. This is particularly true of the radial branch. After carefully freeing the nerves and pulling them aside, the head of the radius was resected with the Gigli saw and the nerves allowed to return to their normal position (See Fig 5). The wound was closed without drainage, the arm was put in semi-flexion, midway between pronation and supination. The patient made an uneventful post-operative recovery. The wound healed primarily. After a month, the plaster dressing which had been applied was removed, and then under massage, passive motion, and electrical treatment the flexion of the elbow and the nerve function were gradually improved. When the patient left the hospital on January 22, 1904, the anaesthesia had greatly diminished, and there was a marked increase in the extension of the fingers and wrist and in the flexion of the elbow. The electrical reactions still showed degenerative changes, but also evidences of marked improvement. Galvanism and faradism to the nerve trunk gave sluggish contractions, as did faradism to the extensor communis. The galvanic response of the muscle was prompt and the A C C > K C C was still present.

The condition of the patient continued to improve, so that at the end of the three years he was practically well. He was last seen by the writer January 18, 1908. He states that for the past



Shagran four y ears after operation Plevion Lateral

FIG 7



Skiagram four years after operation Extension Anteroposterior

year the condition has been stationary and that aside from an occasional trembling of the thumb, a grating at times in the joint on turning forearm, a very slight muscular weakness of the hand, and an insignificant numbness of its back and outer side of the ball of the thumb, there are no subjective symptoms. The patient is easily able to follow his present trade of tinsmith.

EXAMINATION — *Inspection* shows nothing but a healed linear scar in the bend of the elbow. There are no trophic changes.

Palpation — The upper extremity of the radius gives the impression of being the normal head in proper position, rotating under the examining finger. The bowing of the ulna can be felt, but is not striking.

Motion — Flexion at the elbow is almost perfect. Extension is slightly more than normal. Supination and pronation are unimpaired, though passive motion reveals an occasional crepitation in the superior radial joint. There is a very trifling limitation of extension at the wrist and all the movements of the fingers are perfect. The grip is strong.

Sensation — There is slightly impaired sensation of the hand corresponding to the previous area of total anaesthesia. This is most marked on the back of the hand between the first and second metacarpals.

Electrical reactions of the nerve trunk are normal. Local stimulation of the extensor communis with the faradic current gives a somewhat sluggish response. The muscle does not appear hyperexcitable to galvanism, but $A\ C\ C = K\ C\ C$.

Mensuration — There have been no changes in the bony measurements, but the circumferences of both forearms, 5 cm below olecranon are equal, 26 cm.

Radiographic examination shows the upper extremity of the radius rounded and slightly hypertrophied. It is not in contact with either ulna or humerus and seems to lie free in the soft parts. The fracture shows very good union. The angle resulting from the displacement has been filled in by new bone. Superiorly and laterally there is at the site of fracture an apparent hyperostosis, irregularly shaped and of moderate size. (See Figs 6 and 7.)

Interest in the above case, and the very successful outcome of the surgical treatment, induced the writer to examine the literature of ulnar fracture combined with dislocation of the

head of the radius, particularly in reference to the mechanism, the unity, and the types of the injury, on the one hand, and to the nerve complication, on the other. This in turn led to a series of cadaver experiments which were made with the double purpose of reaching some definite conclusion concerning the former problem, in regard to which, since Malgaigne's original contribution in 1854, there existed a mass of doubt and contradiction, and of studying the anatomical relations of the dislocated radial head to the musculo-spiral nerve, and the frequency with which the nerve is involved. I shall not discuss here the question of the combined bone and joint injury, for I propose publishing the results of my researches in this matter at some future date, but shall devote my entire attention now to the latter subject.

Before discussing that particular point which is of especial interest to us here, namely, musculo-spiral nerve injury as a complication of dislocations of the upper extremity of the radius associated with ulnar fracture, it is important that the following be understood. Those deductions drawn in regard to the typical injury of the nerve in cases of the characteristic combined bone and joint lesion, apply in a certain measure to isolated dislocations of the head of the radius. The difference is simply that the latter class of cases is rarer than the former and hence the neurological complication is seen more frequently with ulnar fracture. Another factor that explains the relatively greater frequency of nerve involvement in the fracture cases, is that a greater dislocation of the head of the radius is possible when the ulna is broken than when it is intact, and hence the musculo-spiral nerve or its branches are more likely to be damaged. I have purposely not considered in my discussion injury to the nerve in dislocations of both bones of the elbow. Here the traumatism to the soft parts is so extensive and diffuse, that to draw a characteristic pathologic-anatomical picture of the lesion were well nigh out of the question, though it is not unlikely that musculo-spiral injury even in these instances could occasionally be grouped with the typical cases.

RESUME OF THE LITERATURE

The first distinct reference to the nerve complication is made by GRENIER¹ in 1878. In his thesis on fracture of the ulna, combined with dislocation of the radius, he casually notes in reporting one of his cases that the patient suffered from an extensor paralysis which yielded to electrical treatment. The forward dislocation was never reduced.

The second case is DOERFLER'S² (1886) of complete and permanent paralysis of the extensors in an old unreduced outward and slightly backward dislocation of the radius, with compound fracture of the ulna. He gives an utterly hopeless prognosis in cases of nerve injury.

The third report is by WINNET³ (1894) of a four weeks' old forward and outward dislocation, with fracture of the ulna and a posterior interosseous paralysis. There are no data given as to the outcome of the nerve injury.

The fourth time that this lesion is recorded is by ANNEQUIN⁴ (1898). He gives a detailed account of a case of a month-old forward and slightly outward dislocation with ulna fracture, in which the motor power of the hand was diminished, several anaesthetic zones existed on the hand and forearm, the hand was moist and cold, and the nails showed trophic disturbances. Extension of the elbow caused painful radiations along the radial branch. This is the first case in which both motor and sensory branches were involved, and both incompletely. Resection of the head of the radius brought about a complete restoration of function.

ALBERTIN⁵ (1898) gives us the fifth clinical report of this injury. The patient sustained a fracture of the ulna at its middle, with a forward dislocation of the radius. A musculo-spiral palsy developed at once. The radial head was resected and the paralysis gradually disappeared.

The sixth record is SCHAEFER'S⁶ (1899). In this case, due to a forward dislocation of the radius complicating an ulnar fracture, there developed an immediate complete anaesthesia of the hand with total flexor and extensor paralysis. An injury to the median, ulnar and musculo-spiral nerves was assumed, and operation fifteen weeks after the injury, consisting in freeing the nerves from their bed of scar tissue, resulted in a complete recovery seven months later.

The seventh observation is made by WILMS⁷ (1903), who incidentally remarks that the musculo-spiral nerve was paralyzed in a case of forward and outward dislocation, with fracture near the middle. The case comes from the Trendelenburg clinic and a skiagram is reproduced. No details are given.

The eighth and last reported case is one of Le Dentu's, quoted by MARSAN⁸ (1906). The patient sustained a fracture of both bones of the forearm and a forward dislocation of the head of the radius. A variety of trophic disturbances ensued. No distinct reference is made to the exact nerve lesions except that it is noted that there was a zone of anaesthesia in the area of the distribution of the radial, presumably due to pressure on the anterior branch of the musculo-spiral by the head of the radius. The cold, violet red hand, the "main-en-griffe," and the

anaesthesia were present at the end of three years and were apparently permanent. The head of the radius was not resected.

The case that the writer has observed is then the ninth recorded case of nerve injury in dislocation of the head of the radius complicating fracture of the ulna. He might state here that the total number of cases of the combined bone and joint injury found in the literature was one hundred and nineteen. He has found but one case of nerve injury in isolated dislocation of the head of the radius.

This is reported by CARREY⁹ (1894), who states that his patient had an old forward dislocation of the head of the radius and shortly after the injury developed a musculo-spiral paralysis. There was anaesthesia, mainly on the radial side of the hand, extensor paralysis of the wrist and fingers, with marked atrophy and hyperidrosis. The head was resected on account of limitation of motion in the elbow, and fifteen months later there was a good functional result, though no direct reference is made to the restoration of nerve function.

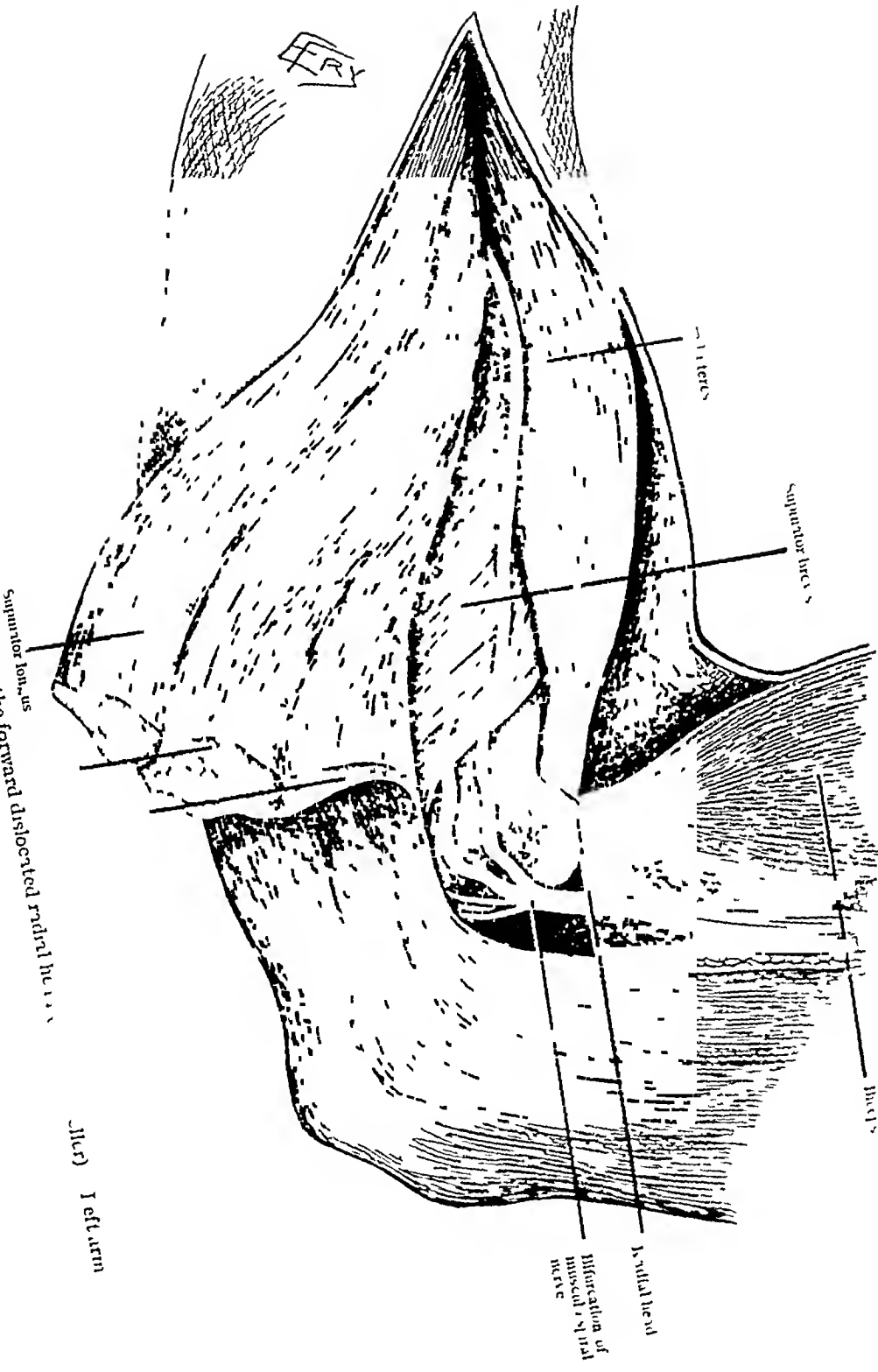
Aside from these clinical records a number of definite anatomical observations have been made, showing that the musculo-spiral nerve is in very close relation to the dislocated radial head.

SCHUELLER,¹⁰ in 1885, first pointed out that the nerve can be stretched just at its point of division by a forward dislocation, and that the deep branch might be involved in other varieties. He demonstrated this by a cadaver experiment and published a picture of the nerve caught by the dislocated head. (See Fig 8.) The clinical aspect is not considered.

LOEBKER,¹¹ the next year, substantiated this fact by a number of experiments and also represented the condition graphically. His picture shows the two divisions of the nerve around the neck of the forward dislocated radius. (See Fig 9.) He urges care in operative work on the radial head, advising a lateral incision to avoid the nerve. He admits having almost divided the nerve in one attempt to resect the head and further states that he knows of a case in which a careless operator directly severed the nerve in attempting resection. His remarks refer purely to the surgical anatomy of the situation and he entirely disregards the possible clinical picture.

DOERFLER also calls attention to the relations of the nerve to the dislocated head, as he noted them in two of his cadaver experiments. In one forward dislocation the nerve was around the neck of the radius and in another instance of forward and outward dislocation it was stretched over the head just at the point of division. In both cases exaggeration of the dislocation—hypertension—would have torn the nerve.

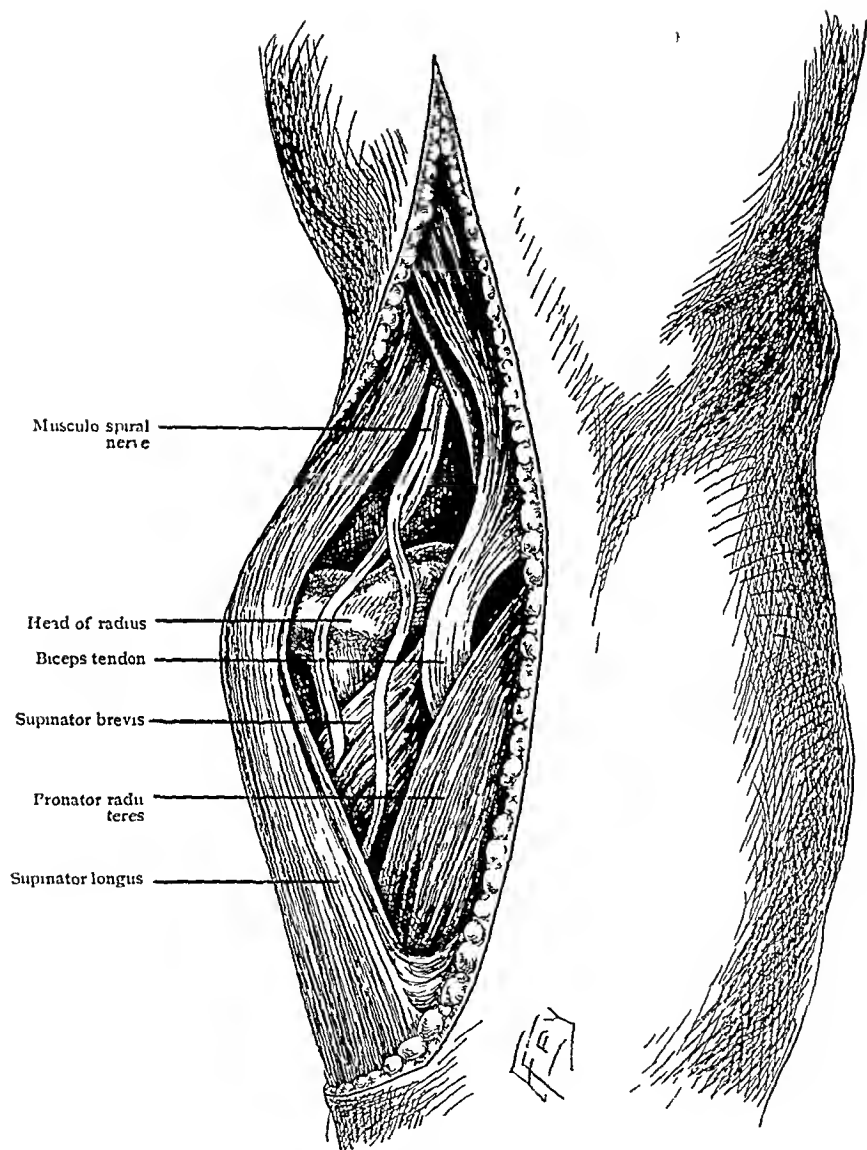
Fig 8



Relation of the musculospiral nerve to the forward dislocated radial head

Left arm

FIG 9



Musculo-spiral nerve around the forward dislocated head of the radius (after Læbker) Right arm This sketch shows anatomical relations almost identical with those found at operation in the case herein reported

ANNEQUIN noted in his case that the radial head had lifted up the musculo-spiral nerve and ALBERTIN made a similar observation at the operation on his patient. SCHAEFER also saw this condition though he did not resect, but simply loosened the nerve from the surrounding fibrous tissue.

In spite of these very positive anatomical observations and the fair number of reported cases, musculo-spiral involvement in radial head dislocation with or without fracture of the ulna has been very generally ignored by the medical teachers.

The older general surgeries make no reference to the subject whatsoever. Rieffel in *Le Dentu* and Delbet's "*Traité de chirurgie*" (1896) calls attention to Grenier's case, and Wilms in the 1907 edition of the "*Handbuch der praktischen Chirurgie*" mentions the lesion in connection with his case quoted above. The latter, however, in his chapter on injuries of the nerves at the elbow and in the forearm totally disregards the question, though he does speak of fracture of the radial head as a cause of the nerve injury. Tillmanns (1898) simply notes the possibility of the nerves being injured in complicated elbow dislocations, while Koenig (1900), though he devotes a separate chapter to injury of the soft parts at the elbow, does not so much as mention the typical lesion. Neither of the two most recent American systems on general surgery (1907) Keen's, and Bryant and Buck's make the slightest reference to musculo-spiral paralysis in elbow dislocations.

Baidenheuer, in his "*Verletzungen der oberen Extremitäten*" (1888), remarks that the deep branch may be compressed in forward dislocations of the capitulum radii, and in his "*Allgemeine Lehre von den Frakturen und Luxationen*" (1907), he merely casually repeats this statement.

Of the special text-books on fractures and dislocations that I have consulted, the older ones, Hamilton (1891) included, contain no allusion to the nerve injury. Stimson (1907), in his chapter on fracture of the ulna with dislocation of the radius, mentions Doerfler's case and notes the possibility of the complication but under the special heading of nerve injury due to dislocations, he absolutely overlooks the ques-

tion Helferich, in his "Frakturen and Luxationen" (1906), speaks of musculo-spiral paralysis as a possible complication of anterior dislocations of the upper extremity of the radius, as do Hoffa in his "Lehrbuch" (1904) and Hennequin and Loewy in their "Fractures des os longs" (1904), though none appears to appreciate the fact that the injury is a typical one or to lay any stress upon it. The last two, even, in their latest publication, "Les luxations des grandes articulations" (1908) do not consider the nerve lesion sufficiently important to mention at all.

Stanciulescu, in his dissertation on dislocations of the radius complicating fracture of the ulna (1890), notes that several cases of rupture of the anterior branch of the musculo-spiral have been recorded as due to radial dislocation, and Pascal, in his inaugural thesis on isolated dislocations of the head of the radius (1907), merely refers to musculo-spiral paralysis in passing. Zieger in his monograph on traumatic dislocations of the radial head (1901) makes a very casual reference to the possible nerve complication.

The text-books and systems on general medicine completely disregard the lesion, and the neurological works treat the subject in about the same manner. Gowers (1895), Dana (1904), Church and Peterson (1905), Oppenheim (1905), and Starr (1907) absolutely ignore radial dislocation as a possible cause of musculo-spiral paralysis, though every other conceivable etiological factor is noted. Grasset and Rauzier (1894) do speak of elbow dislocation as a cause of nerve lesion, but do not specify.

In their monographs on injury of nerves, Weir Mitchell (1872) and Bowlby (1889) both devote a special chapter to injuries due to dislocations, but our particular type is totally neglected. Pearce Bailey's volume of "Diseases of the Nervous System Resulting from Accident and Injury" (1906), likewise contains no allusion to it. Schede and Graff in their article on the surgery of the peripheral nerves in Penzoldt and Stintzing's "Handbuch" (1903) totally disregard dislocation of the radius in the etiology of musculo-spiral

palsy Beinhardt, in his "Erkrankungen der peripherischen Nerven" (1902), remarks that fracture of the head of the radius can cause nerve injury, but no word on dislocation. He is no more explicit in the volume on nervous diseases of the "Deutsche Klinik" (1906). Chapoy (1874), Biberfeld (1893), and Potain (1896), writing on the special subject of musculo-spiral paralysis, are apparently unaware of the danger of traumatism to the nerve from the dislocated head.

Summarizing the situation it is seen that, while a moderate number of cases have been put on record and several investigators have noted distinctly the anatomical connection between the musculo-spiral nerve and the dislocated head of the radius, the fact that this nerve lesion is a typical and characteristic one, has been entirely overlooked. In fact, the very possibility of the injury is only admitted by an occasional author on general surgery, and perhaps somewhat more frequently by those dealing more specifically with dislocations, though in neither instance is any importance attached to the matter nor its significance appreciated. Absolutely no reference is found to this type of nerve injury among the general medical and neurological writers, be it among those dealing with nervous diseases in general, with nerve injuries in particular, or even with musculo-spiral paralysis exclusively.

Of course, the general disregard of this subject by the medical writers is explainable by the rarity, first of radial dislocation, and secondarily of the nerve complication, but the significance and importance of the latter and its comparative frequency in cases of the joint injury have justified the writer in performing the following cadaver experiments to determine the relations of the nerve to the dislocated head and the regularity of the involvement. As he was also interested in the mechanism of the combination of radial dislocation with ulnar fracture he always produced this type of injury. Further, this is the easiest way of causing a dislocation of the radial head, and finally this was the type of radial dislocation which represented the vast majority of the clinical observations quoted

above and thus the conditions during life were most closely imitated

EXPERIMENTS *

EXPERIMENT I—January 6, 1908 German Hospital Left arm of medium-sized, middle-aged, female body Ulna partly sawed through at upper third and forearm bent back over edge of block Fracture, with forward dislocation of head of radius

Dissection—After separating the fibres of the supinator longus, both branches of the musculo-spiral nerve, about 2.5 cm below the bifurcation, are found twisted around the neck of the radius and pushed slightly outward by the head On reduction of the head the nerve slips off, but on redislocating so that the dislocation is slightly more outward, the two branches are directly lifted up by the head If the dislocation be exaggerated, the nerves are dangerously stretched and they could even be lacerated by continuing the hyperextension Flexion of the elbow relaxes the tension on the nerves A tight bandage, with the dislocation unreduced, would severely crush the nerve against the radial head On reducing and redislocating further inward the nerves escape

EXPERIMENT II—Right arm of same body Fracture and dislocation produced as above, but in such a manner that the dislocation is somewhat more outward

Dissection—Separating the fibres of the supinator longus one strikes the two divisions of the musculo-spiral a short distance below the bifurcation stretched over the radial head like violin strings over a bridge Hyperextending the forearm would tear the nerves Flexion relaxes them Simple forward dislocation catches only the radial branch, while more direct outward displacement catches only the posterior interosseous

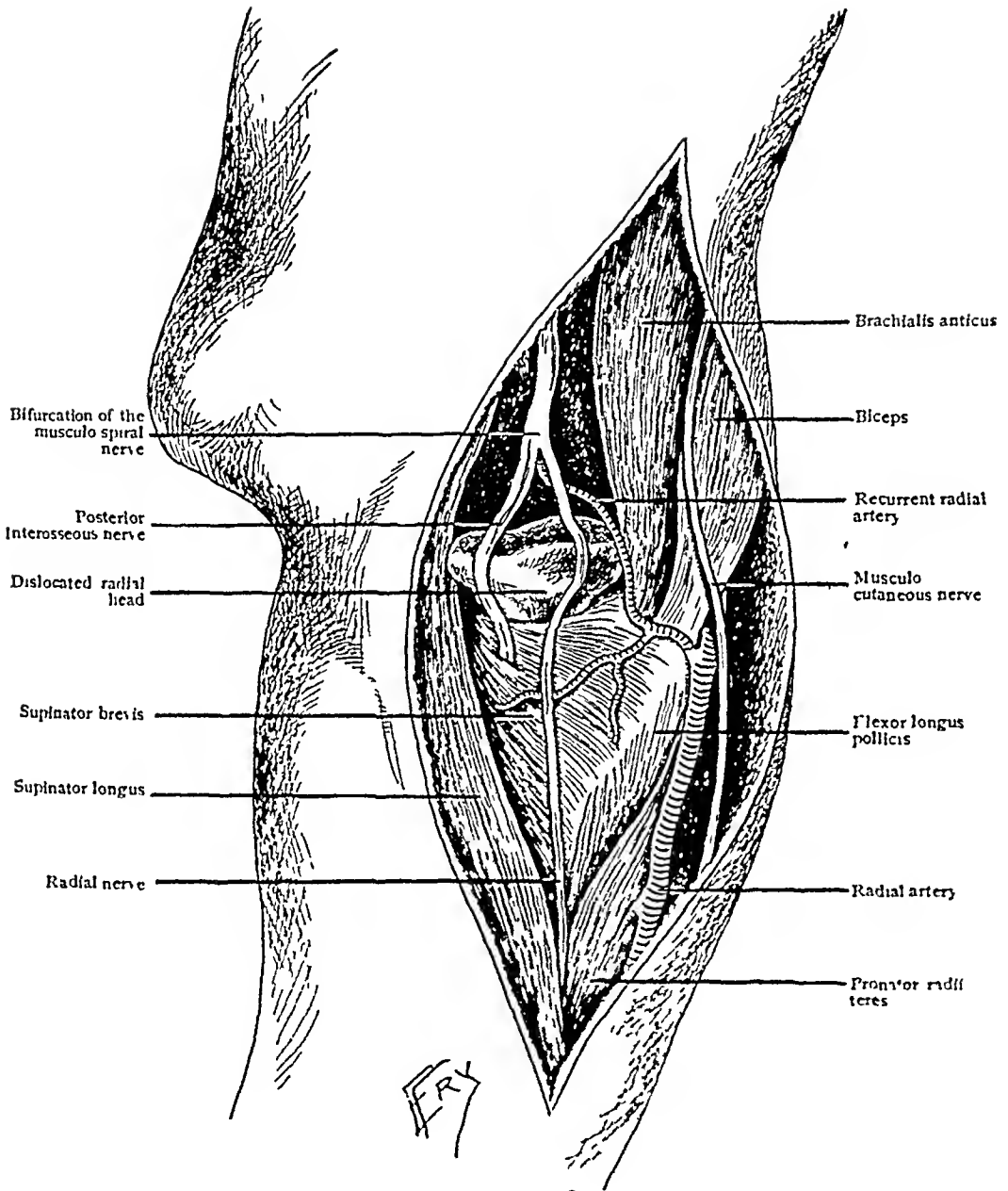
EXPERIMENT III—January 20, 1908 Cornell University Left arm, exarticulated at shoulder of frail, elderly, female cadaver Colles' fracture and fracture at middle of ulna produced by blow on palm and anterior dislocation of head of radius caused by simple hyperextension and supination

Dissection—Separating the supinator longus one sees the two branches of the musculo-spiral lying to the outer side of the head The radial is in direct contact with the bone There is a fracture of the radial head If the dislocation be made a trifle more outward both branches are caught on the head and are stretched by exaggerating the dislocation An attempt to rupture nerve by hyperextension is unsuccessful owing to the fact that the upper part of the nerve is not fixed Even exposure of the trunk of the musculo-spiral in the upper arm and holding this, does not permit of rupturing The nerve slips through the fingers It is very tough and elastic, due probably to injecting fluids that have been used to preserve the body

EXPERIMENT IV—Right arm of same cadaver, also disarticulated from

* Most of these experiments were performed at the anatomical laboratory of Cornell University through the courtesy of Dr I S Haynes

FIG 10



Sketch of condition found in Experiment IV. A similar state of affairs was found in Experiment II. This is a typical relation of the two divisions of the musculo spiral nerve to the forward dislocated head of the radius.

shoulder Compound fracture through base of olecranon, with forward and slightly outward dislocation of the head of the radius produced by blow of heavy mallet

Dissection—Shows the two branches of the nerve slightly stretched over the head of the radius as in Experiment II The tension is increased by further extending the forearm and relaxed by flexion (See Fig 10)

EXPERIMENT V—February 7, 1908 Cornell University Right arm, fair-sized, elderly male cadaver Fracture of ulna above styloid process and later at lower third Hyperextension produced typical backward dislocation of both bones of the elbow, but incomplete

Dissection—Retracting the supinator longus, one sees both branches of the musculo-spiral relaxed and some distance away from the bone This is particularly true of the radial, which could not possibly be injured in this dislocation The posterior interosseous might be caught if the dislocation were more outward, but it is difficult to conceive how a simple backward dislocation could injure the nerve which simply relaxes and slips from the neck of the bone In extreme dislocations backward it is possible that it might be stretched

EXPERIMENT VI—February 25, 1908 Cornell University Left arm of cadaver used in previous experiment Forward dislocation of the head of the radius, produced by hyperextension of the forearm after base of olecranon had been fractured by sharp blow of mallet

Dissection—The upper extremity of the radius has lifted up and stretched the radial nerve, while the posterior interosseous has entirely escaped If the dislocation be reduced and the head of the radius be redislocated slightly more outward, both branches are caught The nerve slips from the bone in an attempt to rupture by increasing the extent of the dislocation If the radius after having been dislocated forwards, be pushed upwards about 2 cm the main trunk of the musculo-spiral is impinged upon by the head of the bone

Before drawing any further inferences from the above experiments, I shall now briefly discuss the

SURGICAL ANATOMY OF THE MUSCULO-SPIRAL NERVE AT THE ELBOW JOINT

Piercing from behind forwards the lateral intermuscular septum above the lateral condyle, the musculo-spiral nerve quits its groove on the humerus, and descending between the brachialis anticus and supinator longus muscles it divides into two branches, the radial and posterior interosseous nerves, just above and in front of the eminentia capitata of the lateral condyle. Just above the point of division are given off mus-

cular branches to the supinator longus, extensor carpi radialis longior and usually to the outer part of the brachialis anticus.

The radial nerve or superficial branch is slightly smaller, is situated medially, and is a purely sensory nerve. It passes over the humero-radial joint and then down along the radial side of the front of the forearm. It is covered by the supinator longus and is gradually approached on its medial side by the radial artery which meets it at about the middle of the forearm.

The posterior interosseous nerve or deep branch is the larger of the two divisions, lies external and posterior to the radial and is in the main a motor nerve. It passes over the humero-radial joint obliquely outward and downward, and just below the head of the radius it pierces the supinator brevis which presents a C-shaped opening for its reception. It passes between the two layers of this muscle, winds in a half spiral turn laterally around the upper part of the shaft of the radius and emerges posteriorly 6-8 cm. below the external epicondyle, lying between the extensor communis and the extensors of the thumb.

The point of division of the musculo-spiral and the two branches for several centimeters below it are then in direct relation to the humero-radial joint, only separated from the bone by the anterior and orbicular ligaments. The nerves are comparatively fixed in their position, and very slightly movable, hence liable to injury. The nerves are held in place in the fascia of the supinator longus, which, if lifted up, takes the nerves with it.

The superficial branch or radial supplies the integument of the radial side of the ball of the thumb, the greater part of the dorsum of the hand, the thumb, index, middle and radial half of the ring finger. It anastomoses with the musculo-cutaneous and ulnar nerves.

The deep branch or posterior interosseous supplies the following muscles,—extensor carpi radialis brevis, supinator brevis, extensor communis digitorum, extensor minimi digiti, extensores pollicis (longus et brevis), extensor indicis and ex-

tensor ossis metacarpi pollicis A sensory terminal branch is distributed to the wrist joint

CLINICAL SUMMARY

Pathogenesis and Pathology —In view of the anatomical conditions it is easily understood that in nearly every dislocation of the head of the radius the integrity of the two branches of the musculo-spiral is threatened. This is especially true of anterior dislocations. In this type, the upper extremity of the bone is likely to directly impinge upon the two branches of the nerve, and this occurs almost invariably just below the bifurcation. As a result of the analysis of the reported cases and the experimental investigations I believe we are justified in assuming that —

a In forward and slightly outward dislocation one or both branches are most likely to be caught. Five out of nine of the cases with ulnar fracture demonstrated this.

b In forward and inward dislocation, the nerves usually escape involvement.

c In forward dislocation, the radial alone may be injured while the posterior interosseous may escape.

d In outward dislocation the posterior interosseous alone may be involved and the radial may be free.

e In backward dislocation, neither nerve is liable to be injured. It is almost out of the question that the sensory branch be affected in this type, but in extreme cases the deep branch might be stretched.

f In forward dislocations where there is a marked displacement upwards the head of the bone might strike the main trunk of the nerve.

When the dislocation is a complication of fracture of the ulna, the nerve is much more likely to be affected, as the displacement of the radius is usually much greater under these conditions. While the literature of simple dislocation has not been reviewed by me as exhaustively as that of the combined fracture and dislocation, I have examined the large majority of the special papers on the former subject and have found

but one case of nerve injury, while in the latter class I have found nine instances. Although there is great probability that even in simple dislocations the nerve injury is more frequent than the one case found would indicate, the proportion of one to nine is significant.

As to the exact nature of the nerve injury, this is usually a direct contusion by the protruding bone or an actual laceration, complete or partial, followed by the usual degenerative changes. In the operated cases, the nerves were never found completely torn across,—though in my case the nerve fibres seemed completely divided and the nerve ends were held together merely by fibrous strands, the remains of the sheaths.

The nerves are usually stretched directly over the radial head, and hyperextension, which exaggerates the dislocation tends to increase the tension of the nerve, and likewise the injury. One or both nerves may be pushed medially or laterally, or the head may emerge between the two branches producing an injury in this position.

It is conceivable that under certain conditions the nerves might simply be stretched without coming in contact with the bones, and thus sustain, from the pull, a partial or complete rupture. This would be the mechanism in posterior interosseous paralysis due to posterior dislocations. The nerve injury usually takes place directly at the time of the joint lesion.

The frequency of this nerve complication is comparatively great as statistics of its incidence in cases of the double bone and joint lesion indicate. In the one hundred and nineteen cases of fracture of the ulna associated with dislocation of the upper extremity of the radius, which I have succeeded in collecting from the literature, the nerve was injured in nine cases, or 7.56 per cent.

Symptomatology and Diagnosis —The symptoms are very much the same as the classical ones of musculo-spiral palsy added to the usual ones of fracture and dislocation or dislocation alone. They may be complete or incomplete in their distribution or their degree, depending upon whether one or both

branches are involved and to what extent. As the main trunk of the nerve appears never to be injured, except in decided upward displacements, there may be only sensory or only motor symptoms, if only the radial or only the posterior interosseous be caught—or if both branches are damaged the symptoms will be mixed. Of the ten reported cases four were mixed, three were purely motor and one was apparently a purely sensory paralysis. In two the nature of the paralysis was not specified.

The usual anaesthesias in the area of the radial distribution, the extensor paralysis, and the trophic disturbances are too well known to detail here. These are regularly present and are partial or complete according to whether the nerve conduction be completely or only partially destroyed.

One characteristic and significant fact is that the supinator longus is not likely to be paralyzed, as its branch is given off just above the bifurcation.

The nerve symptoms usually develop promptly after the injury. The diagnosis of the lesion is self-evident.

Prognosis and Treatment—The prognosis of this form of musculo-spiral paralysis is good, notwithstanding Doerfler's opinion to the contrary. In only two of the ten cases is it definitely stated that the paralysis was permanent. Six were positively cured, and in two the final result is not indicated. The ultimate restoration of function is of course best if the correct treatment be applied as soon after the injury as possible.

Treatment consists primarily in freeing the injured nerve and this, fortunately, generally corresponds to the regular treatment for the dislocation itself.

1. If possible, *i.e.*, if the injury is recent, a bloodless reduction might be attempted. This can be accomplished by extension, traction, and then flexion. Pressure on the head of the radius advocated by some authors should be avoided for fear of further damaging the nerve—as also hyperextension. After reduction the arm can be put in plaster, in semi-flexion midway between pronation and supination. The ulnar fr-

ture simply requires the usual reduction of the deformity and anterior and posterior splints or a plaster dressing

2 If the attempt at simple reduction is not successful and the ulna fragments are still ununited, an arthrotomy with reduction of the radial head and suture of the capsule tear, as advocated by Sprengel¹² in isolated dislocation, might be tried. However, this procedure will only be of service in very specially selected cases in which there has been no too great disturbance of the adjacent tissues. Further, if the articular surfaces have been destroyed, if the head is hypertrophied, and especially if the ulna fragments have united with shortening of the bone, arthrotomy is of little use.

Osteoclasis of the ulna, proposed by Doerfler, may be of service if the deformity of this bone is very great, but simply to lengthen the ulna in order to render arthrotomy possible, does not justify refracture.

3 Resection of the head of the radius, first suggested by Loebker¹³ and later advocated by numerous other surgeons in old dislocations of the head of the radius, is unquestionably the operation of choice in the majority of older cases, where reduction is not possible by the bloodless method. This accomplishes the double purpose of relieving the nerve and of restoring the impaired elbow function in the simplest manner possible. The lateral incision of Hueter¹⁴ should be used to avoid further damage to the nerve, and the most practical way of removing the head is with a Gigli saw. Four of the ten cases collected were cured by resection.

4 Suture of the nerve by one of the approved methods must of course be performed should it be found ruptured at the time of operation. Yet, if the remains of the nerve sheath hold the ends of the torn nerve together, it is scarcely necessary to sew the nerve, as my case demonstrates. If, after simple reduction there be no improvement within three months, the nerves must be exposed, as rupture or scars are probably responsible for the non-improvement and must be treated.

5 Electricity, massage, active and passive motion, and

stimulating medication should be used as adjuvants of the surgical treatment

6 Prophylactically the following might be emphasized In all cases of dislocation of the head of the radius in which the nerve is not involved, the fact that the nerve is in close relation to the dislocated head must be borne in mind and care must be exercised not to produce a nerve lesion by rough or careless manipulation, particularly in the sense of hyperextension or direct digital pressure on the head of the bone The known proximity of the nerve to the radial head should in itself constitute a definite indication for reduction, for even if there is no primary paralysis a pressure paralysis may develop secondarily, if the dislocation remain unreduced One should likewise avoid applying a tight bandage before the dislocation has been reduced, as the nerve might easily be compressed against the bone Further, in all operations on the dislocated radial head the position of the nerve must be remembered, so that it is not injured by careless operative technique

CONCLUSIONS

1 Musculo-spiral paralysis as a result of dislocation of the head of the radius is a distinct type of nerve injury, and is quite as definite and characteristic as any other form of injury to this nerve In fact, in every case of anterior dislocation of the head of the radius the two divisions of the musculospiral nerve are in danger and it is a fortunate accident if they escape

2 Its actual occurrence is naturally rare, but comparatively, *i e*, compared to the frequency of the joint injury itself, it is not infrequent

3 It is most likely to occur when the dislocation accompanies ulnar fracture and when the direction of the dislocation is forward and slightly outward

4 The nerve is almost invariably injured below its point of division into the posterior interosseous and radial One or both branches may be caught by the dislocated head

5 The symptoms are practically those of the typical

CONGENITAL DEFECT IN THE ULNA

BY FRANCIS DENISON PATTERSON, M.D.,

OF PHILADELPHIA,

Surgeon to the Howard Hospital

THE condition of congenital absence of the ulna is one of the rarest anomalies to which the skeleton is liable. My patient also presented the extremely interesting feature of there being associated with it a true hyperplasia of bone in other portions of the body. A few of the numerous exostoses, from which she also suffered, are clearly shown in the accompanying X-ray photographs.

She first presented herself to me for treatment about two years ago, at the dispensary of the Howard Hospital, for what she believed was a dislocation of the right wrist, as the result of a traumatism and at that time I elicited the following history. M. D., aged 16 years, white, and by occupation an actress.

Family History—Father living and well. Mother living but bed-ridden with "dropsy", three brothers and three sisters living and well, four brothers and three sisters dead, two of diphtheria, one of meningitis and the others in infancy. Has no knowledge of any tuberculosis, malignant disease or syphilis in the family. No other member, immediate nor remote, of her family has suffered from any deformities.

Previous History—Had diphtheria, scarlet fever, measles, chicken pox and typhoid fever two years ago, from all of which diseases she made a good recovery. Six months ago she noticed that exostoses were appearing, especially about the knees and ankles and the arms. Since that time they have steadily increased in size, and give constant pain which is increased by motion and pressure. She states that a "lump" appears whenever she receives a traumatism.

History of Present Condition—Was playing with her sister who caught her by the right hand and gave it a violent pull,

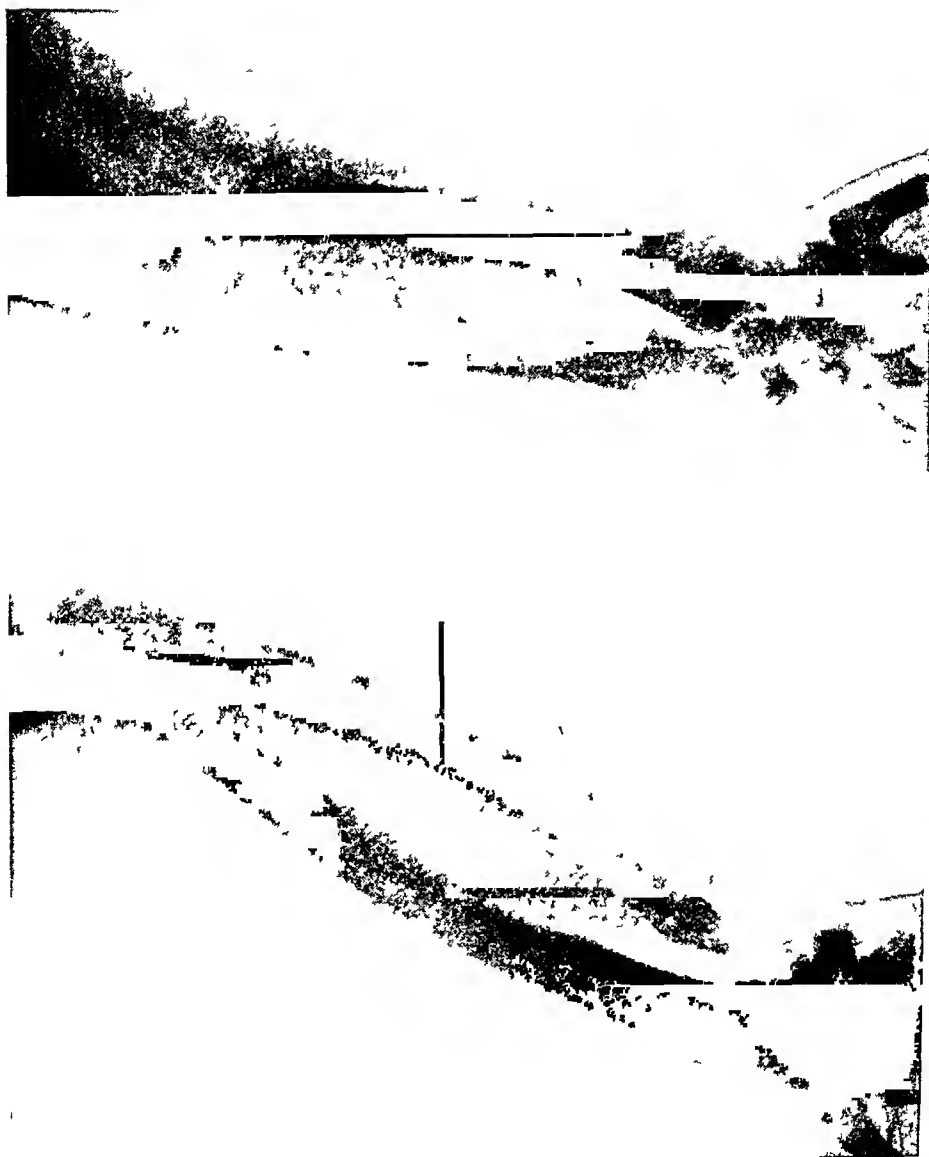
* Read before the Philadelphia County Medical Society, February 26, 1908.

FIG 1



Absence of lower end of right ulna

FIG 2



Right forearm

Congenital defect in ulna

Multiple exostoses

Left forearm

which was at once followed by a marked deformity and complete loss of motion of the wrist joint. An attempt was made to make an examination without an anesthetic but the patient was very hysterical, so ether was given and the wrist joint was found not only freely movable in all directions, but the absence of the lower end of the ulna could be clearly felt. Further examination showed the presence of numerous exostoses. They are very marked on the upper end of the right humerus and on the left radius. The right wrist was dressed with a solution of lead water and alcohol and then put at rest upon a splint. X-ray photographs (see Fig 1) were taken later that day and they show not only the absence of a portion of the ulna but also the exostoses on some of the other bones. Under rest the inflammation rapidly disappeared from the wrist joint and the patient soon had as good use of this arm as she had prior to the accident. I urged operation upon the exostoses, but the patient declined it, and I lost sight of her until she was admitted a year later to the Philadelphia Hospital, in the service of Dr J Chalmers Da Costa, and on June 13, 1906, his assistant Dr Schwartz removed a number of the exostoses from the upper part of the tibia on both sides and from the external condyle of the femur on the right side. These were found to be very hard and attached firmly to the shaft of the bones. The patient made an uninterrupted recovery, and was eventually discharged from the hospital proper to the "Out Wards." She was readmitted to the surgical ward of the hospital in March, 1907, and on the 19th of that month she had the exostoses removed from the lower limbs. Two from the right knee, one from the outside and one from the inside. One from the outside of the left knee, the only one which was not firmly adherent to the femur. One also was removed from the lower end of the right fibula. The patient again made a good recovery and returned to the out wards. She has been there ever since except when admitted to the hospital, once for a gynecological operation and again for operation for appendicitis, both of which were successful.

Congenital absence of the ulna is a very rare condition. after a careful search of the literature I have been able to find but eight other reported cases. Forster, in his classical monograph, "*Missbildungen d Menschen*," does not even mention

this anomaly, although he notes the frequent absence of the radius. The cases that have been previously reported are briefly the following:

1 GOLLER (quoted by A. Schnelle, "Inaugural Dissertation," Göttingen, 1875), in 1698, described a seven months' old foetus, in which both ulna with four fingers were absent, only the radius and both thumbs being present, and in the lower extremities only the tibia and great toes were present.

2 SENFTLEBEN (Virchow's Archiv, xlv, 1869, p. 303) notes the case of a recruit, aged 21 years, in whose left ulna there was a defect occupying the middle third of the bone. This defect measured two and one-half inches, and where the bone was absent a ligamentous band could be felt. The patient was in every other way normal.

3 ROBERTS (Trans. Path. Soc., Philadelphia, xiii, 1885, p. 4) reports the case of a man, 73 years old, whose right ulna was absent along with the third, fourth and fifth digits and their metacarpal bones. The pisiform, cuneiform and unciform bones were absent from the wrist. On the left side the ulna was present, but the third and fourth digits and the third metacarpal bone were wanting. The patient stated that his sister had one hand deformed like his and that she was the mother of a perfectly formed child. Another sister's child had a hand deformed like his right hand. The patient further stated that he had seven children, of whom three had malformations similar to his.

4 PRINGLE (Jour. of Anat. and Physiol., xxviii, 1893, p. 239) states that he had under observation, a man, aged 31 years, in whom both ulnae were absent. There was no family history of deformities. The mother stated that the patient was born at full term, but during the early months of pregnancy she had received a severe fright. Right arm. The hand is provided with three fingers only, one well developed, which appears to be the middle finger, and two malformed ones, one to each side of the former. The wrist joint is freely movable, the trapezium is absent, but it is not possible to determine if any other carpal bones are wanting. There is no trace of the ulna. Left arm. The hand is narrower and less well shaped than the right, it also is provided with only three digits, the best developed of which seems to be the index. The wrist joint is freely movable, and the left trapezium is present. There is no trace of the ulna.

5 LANE (Trans. Clin. Soc., London, xxxii, 1898-9, p. 44) reports the case of a girl, 3 years of age, whose ulna consisted of two separate parts, whose pointed extremities slightly overlapped and whose axes varied considerably in direction. The lower end of the ulna was situated considerably above the level of the extremity of the radius. No evidence of any other deformity. It is interesting to note that this deformity was successfully corrected by the wiring in of the femur of a rabbit.

6 YUDT (Vrach. Gaz., S. Peterb., x, 1903, p. 342) notes the case of a woman, aged 62 years, who presented herself for treatment for a

fracture of the neck of the left humerus and in whom the right ulna was almost entirely absent. It consisted of a piece of bone, 7.5 cm long, extending downward from the elbow. The radius was arch-like in shape and somewhat thickened below where it articulated with the carpus, its upper extremity was dislocated forward and outward. The right hand was smaller than the left but all its bones were present. The only other deformity was an absence of the right pronator quadratus muscle. All the normal movements of the fore arm were well preserved except flexion of the elbow, which was much limited for purely mechanical reasons.

7 KACKKACHEFF (Russk Gaz S Peterb, III, 1904, p 325) reports the case of a man, 24 years of age, in whom the left ulna was entirely absent. Pronation was well preserved. There was no other deformity.

8 AGAYEFF (Vrach Gaz S Peterb, XII, 1905, p 155) notes the case of a man, 40 years, who gave a history of polydactylism in his mother, who had it in one of her feet, and in an uncle, on his father's side, who had it in both feet. The patient had had four children and all were perfectly formed. Right arm. The only deformity was polydactylism of the little finger. Left arm. This arm was flexed at the elbow and in incomplete pronation. The hand had but three fingers, the thumb, index and middle. A rudiment of the little finger was also present. The humerus was normal and in the trochlear region was a round bony prominence, of the shape of the patella, movable in all directions and attached to the tendon of the triceps muscle. The ulna was completely absent, except for this rudiment. The little finger and the fourth and fifth metacarpal bones were absent, as was also the unciform and os magnum. The movements of this hand were somewhat limited, chiefly for mechanical reasons. No evidence of any other deformity.

The literature of multiple exostoses is indeed a voluminous one. I have gone through it with care and been able to find only one case where the hyperplasia of bone was associated with a congenital osseous defect. Battle (Trans Clin Soc, London, XXXIX, 1905-6, p 252) reports the case of a girl, 13 years of age, who had osteomata on nearly all the long bones, near their terminal epiphyses. The right ulna measured only six and one-half inches, while the left measured nine inches. The bone was well formed, only it was shorter than the radius, which had its shaft bowed outward and the head of the bone was displaced forward and outward.

THE SURGICAL TREATMENT OF BUNION

BY CHARLES H MAYO, M D,

OF ROCHESTER, MINN

THE discomfort suffered by patients afflicted with bunions is so far in excess of the apparent simplicity of the malady that the disease has come to be a subject well worthy of consideration from a surgical point of view. The condition is usually associated with hallux valgus and is attributed to various causes, the principal one being the wearing of pointed, short and tight shoes. Arthritis and gout may be contributing factors in some cases. From the examination of many patients with this trouble, it appears that the peculiar shape of some feet renders them liable to this deformity. The primitive foot was probably used for grasping objects, the great toe being situated farther back, somewhat like, but less marked than the thumb on the hand, and as is now seen in some of the lower animals.

Confinement of the foot incident to civilization, has possibly tended to the advanced position of the great toe, though many feet still present the short great toe with the wide foot in which the second and often the middle toe is the longer. Such feet rarely have the deformity "hallux valgus," although some slight bunion may be present, and this regardless of the kind of shoe worn.

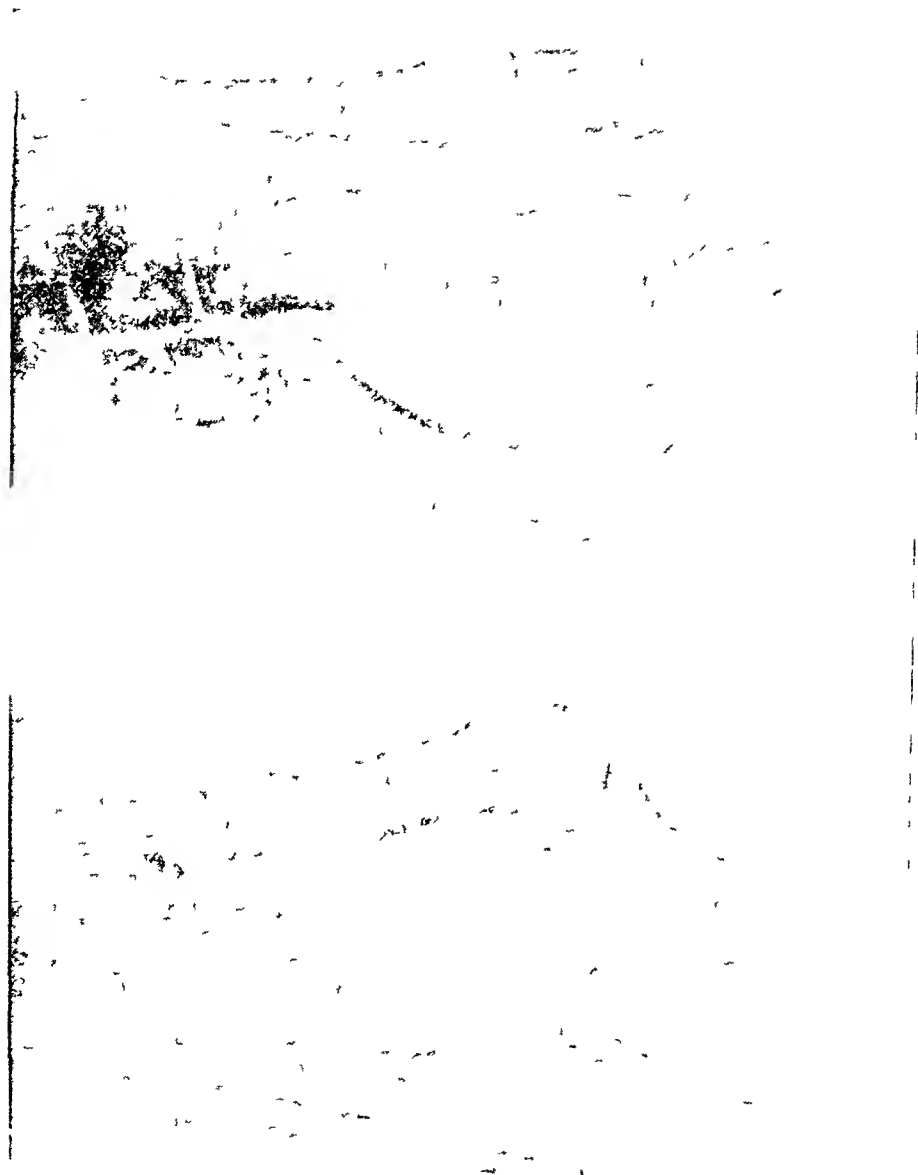
The characteristic of the foot with tendency to bunion is, that the great toe when straight is from one-fourth to one-half inch longer than the second toe. This type of foot may remain a perfect foot through life but should it become confined in a pointed-toe, narrow, and especially a short shoe, the leverage action against the inner side of the great toe develops hallux valgus with true bony growth on the inner side of the head of the metatarsal bone which becomes covered by a bursal layer. This area becomes most painful to pressure and is liable to special attacks of inflammation. The tendon of the

FIG 1



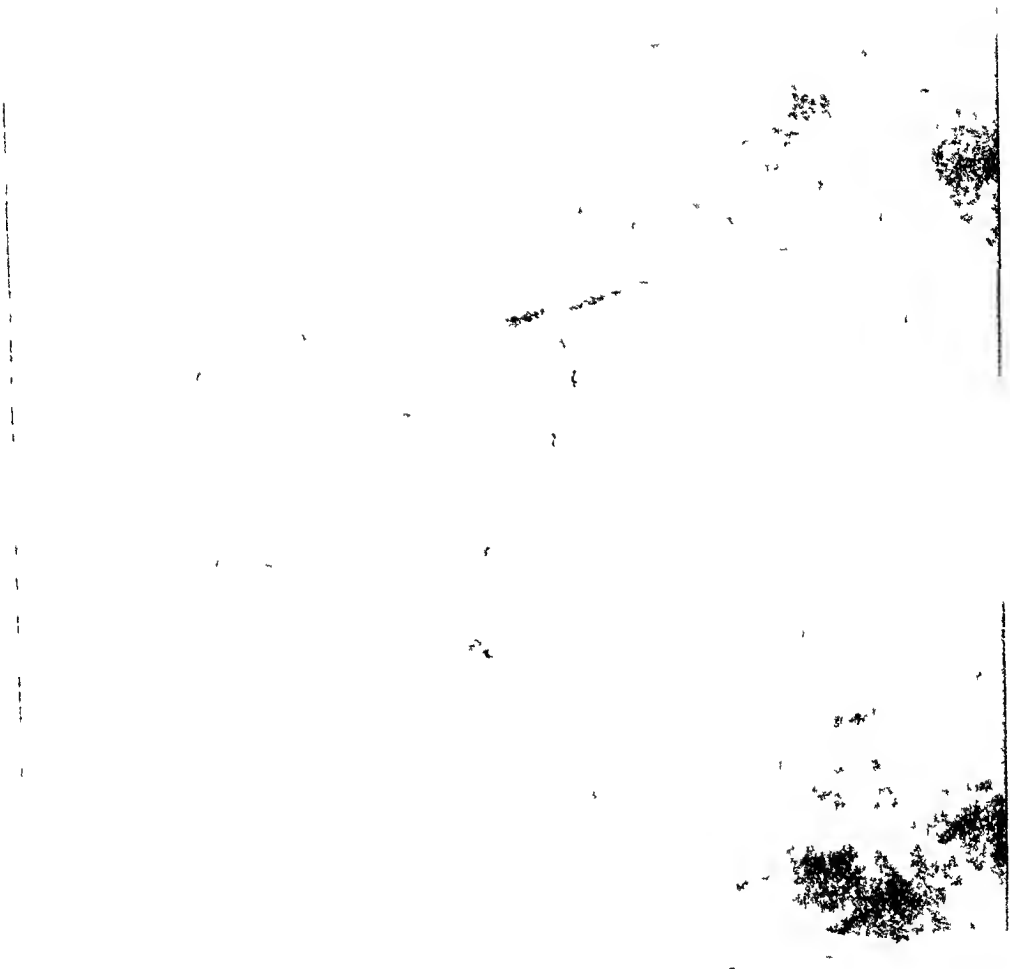
Hallux valgus deformity as shown by photograph

FIG 2



Deformity as shown by radiograph

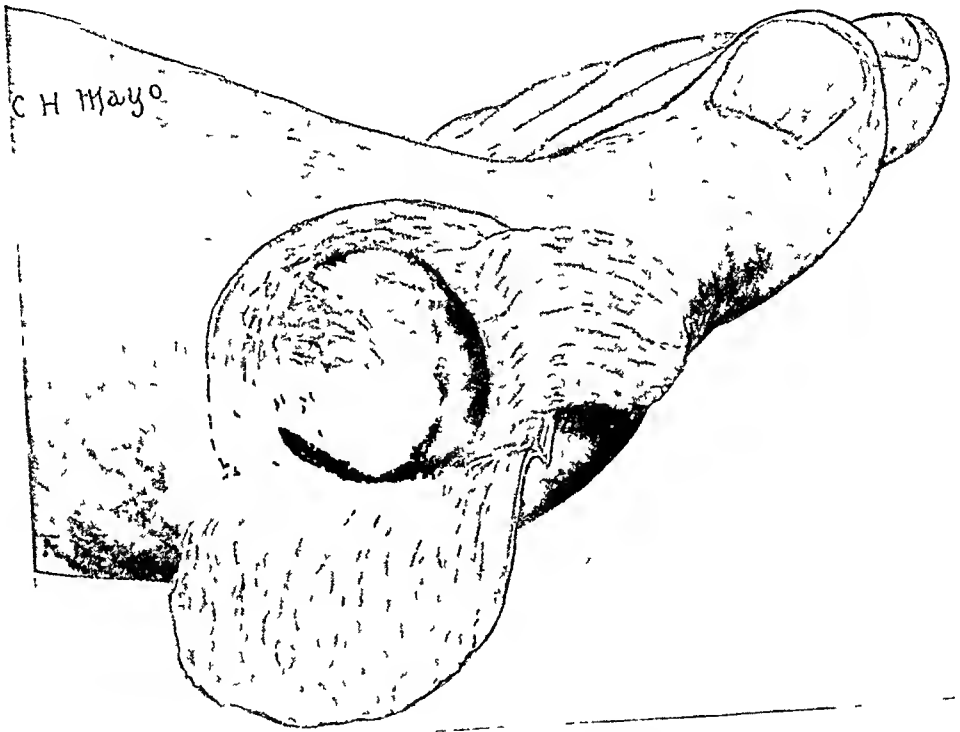
Fig. 3.



Radiograph of result after nine months

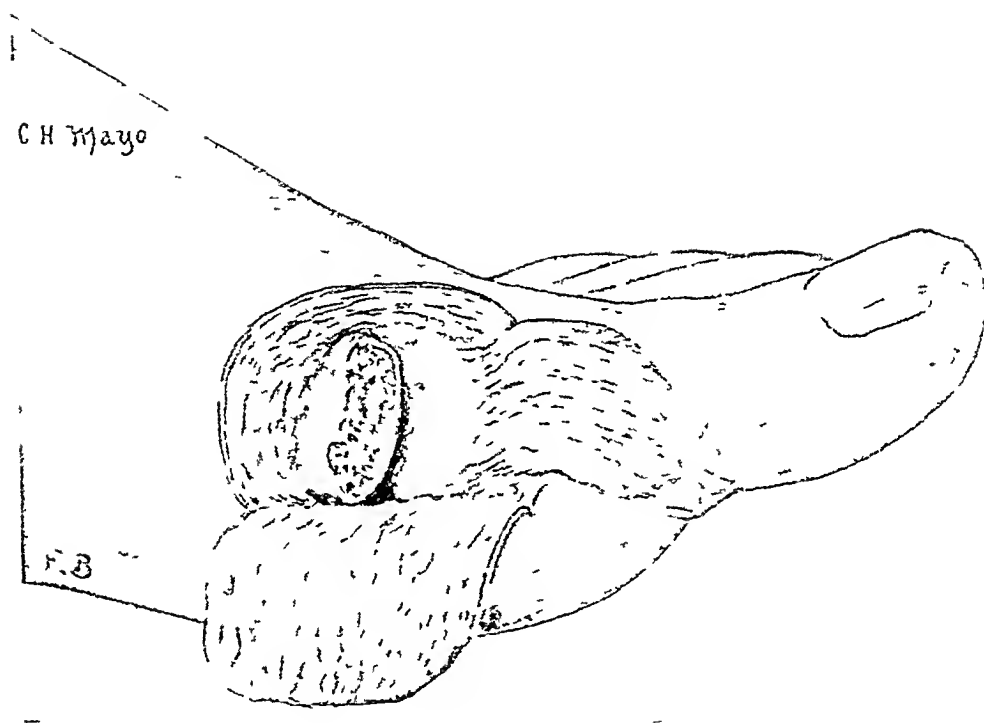
R₂

FIG 4



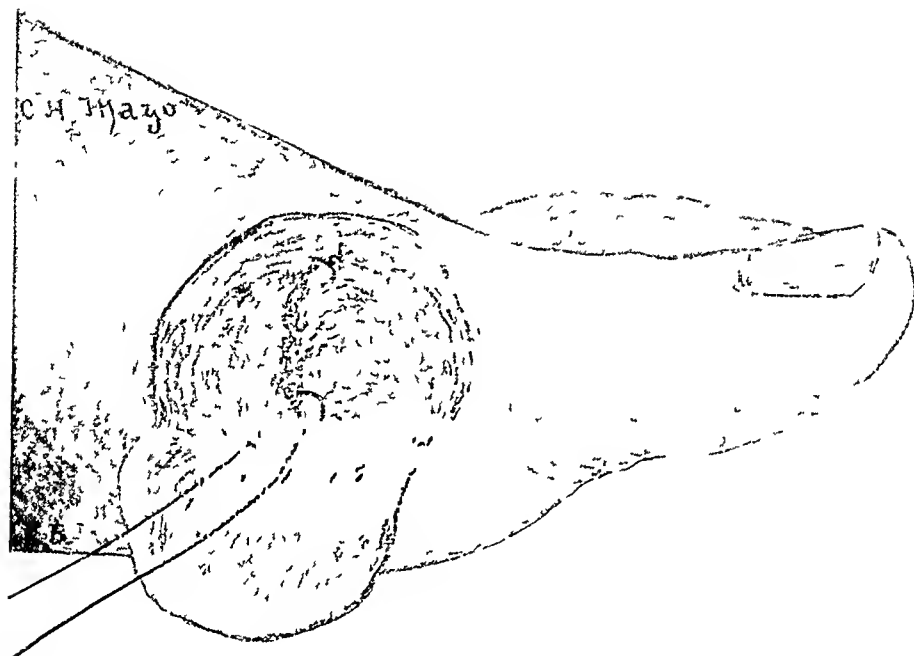
Showing bony deformity

FIG 5



Bone section ready for insertion of bursa

FIG. 6



Suturing of bursa to develop joint

extensor proprius pollicis becomes displaced to the outer side of the joint area, and with the angulation of the toe its sheath becomes a pulley which soon gives way to tension, after which the tendon acts to still further increase the deformity

Many patients have the trouble in so slight a degree that proper shoe-fitting will relieve them. Some secure comfort by wearing special appliances for supporting the toe or protecting the bunion

Several operations are recommended for the cure of hallux valgus. Resection of the metatarsophalangeal joint is often practiced, also a wedge-shaped or simple osteotomy of the metatarsal bone, which will relieve some cases but does not narrow the foot or remove the bunion, if it is present

It is also recommended by some operators, to remove the head of the metatarsal, and, to avoid the scar about the inner side of the joint, their incision is made between the first and second toes

For a number of years we have practiced the following method in operating upon patients afflicted with this trouble and the regularity of its success leads us to present the technic of the method

Operation—A curved incision is made base down over the inner side of the metatarsophalangeal joint, the skin being lifted in the flap which is separated from the bursa. A curved incision "horse-shoe" is now made around the bursa with its base forward left attached to the base of the first phalanx, its inner surface being synovial membrane and continuous with the anterior surface of the joint

The head of the metatarsal bone is then removed with heavy forceps, the section also removing two-thirds of the anterior portion of the bony hypertrophy on the inner side. The remainder of this projecting bone is cut away to the level of the shaft of the metatarsal. The cut end of the metatarsal bone is now rendered as smooth as possible by rongeur forceps and the bursal flap turned in to the joint area in front of the bone, where it is held in place by one or two catgut sutures. We thus utilize an already formed bursa to secure and main-

tain a movable joint which works in a movable splint,—the shoe,—and thereby secure an immediate result, which is obtained with difficulty in other joints by transplanting fatty tissue into the joint area to prevent bony union, an operation made familiar by the efforts of Dr J B Murphy, who has demonstrated its great value in certain cases where the joints have become fixed by injury, disease, or operation. But in these cases, there being no natural fixed support like the shoe, it is necessary to use apparatus to limit and direct the motion. In some cases the tendon and sheath of the extensor proprius pollicis is best displaced by suture to the inner side of the mid-line of the toe.

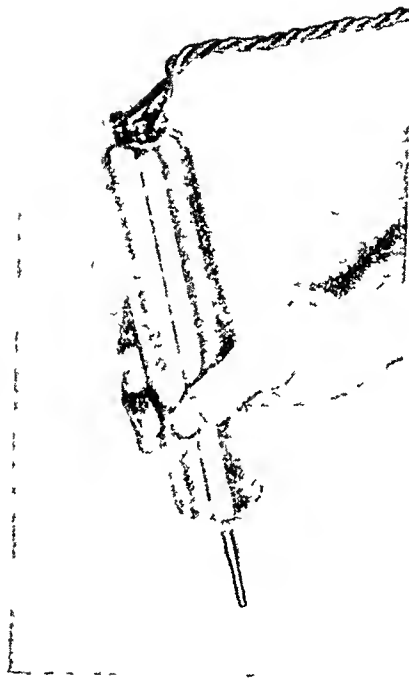
Provision is made for drainage by a punctured incision in the base of the skin flap in which is inserted a doubled catgut strand. The skin incision is now sutured in place with horse-hair or catgut. The dressing is a pad of gauze wet in 70 per cent alcohol, placed between the great and second toes. The anterior portion of the foot is covered with a dressing which is moistened with the same solution at intervals during the first few days.

With ordinary care in protecting the wound these patients are often much better able to go about within two weeks than they were before the operation. It frequently occurs that they are not even kept in the hospital during convalescence.

The motion becomes nearly perfect. The great toe is shortened to a reasonable degree, somewhat narrowing the foot at its widest line, a factor of importance in the prevention of recurrence. The bearing surface for support is excellent as the under side of the joint floor is not disturbed, and the cushion beneath with its sesamoid bones is left intact.

Theoretically it could be said, that the scar is badly placed and would be subject to pressure from the shoe. Practically this is not true, as we have found from operating upon 65 cases during the past eight years according to this method.

FIG 1



Motor held in hand ready to operate

A NEW MOTOR FOR BONE SURGERY.⁴

BY W. SOHIER BRYANT, M.D.,

OF NEW YORK

DESCRIPTION of motor 3/10 horse-power, 3 phrase, 10 volts, 15,000 revolutions per minute, 185 cycles, 2 poles, diameter, $2\frac{1}{8}$ inches, length of barrel, $9\frac{1}{2}$ inches, weight, 7 lbs 5 ozs

This motor is unique in as much as it is the first practical application of well known electrical principles in such a way as to combine three-tenths horse-power with a weight of only seven pounds, about one-eighth that of the ordinary motor of equal power. Because of its light weight it fills the requirements better than any other motor for use in the flying machine where weight is the chief difficulty to be overcome. The great advantage in thus reducing the size and weight of the motor is that it can readily be held in the hand and is able in this way to solve the problem of shafting or gearing by doing away with both.

In point of speed this motor is again far in advance of any now on the market, making 15,000 revolutions per minute. Owing to this velocity and power, the instrument is very effective since it eats up the bone with great rapidity and saves much valuable time. On account of the speed of the motor a phrase is used with only one cutting edge which cannot clog. The phrase does not heat as all the heat generated is taken up by the chips. The motor can be used as a drill, as a bur to enlarge a bone cavity, as a phrase to cut an osteoplastic flap, and lastly as a trephine. It will not cut soft tissue. An important surgical point is that this instrument together with its wire connections can be sterilized.

The motor was designed and constructed for Dr. Bryant by the International Instrument Co. of Cambridge, Mass.

* Presented before the Section on Surgery of the New York Academy of Medicine, February 7, 1908

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 25, 1908

The President, DR JOSEPH A BLAKE, in the Chair

LARGE LUMBAR HERNIA TREATED BY SILVER FILIGREE

DR FORBES HAWKES presented a man, 44 years old, who after a nephrectomy done eight years ago, had developed a large lumbar hernia. This had been reduced and a silver wire filigree netting inserted. As the result of a fall this filigree was broken and six months later small pieces of the wire began to extrude, it was finally necessary to remove it entirely. A more flexible silver wire filigree netting was then inserted, and this had now been worn by the patient for over two years with perfect comfort. It seemed probable that one of its strands also had become separated.

DR WILLY MEYER said he had often resorted to the use of silver wire filigree in dealing with large hernial protrusions with entire success. In his first case, which was operated on in 1901, as well as in many subsequent cases, the filigree had remained in place and was very satisfactory. The method should be limited to those cases with large hernial apertures that could not be otherwise closed.

Dr Meyer said that in one case where he employed this expedient the wall of a coil of small intestine was accidentally caught in stitching the filigree into place, and the gut finally perforated and a fecal fistula formed. This is the only one in his series in which the filigree had to be removed later. In every other one it staid in place. He feels convinced that the silver wire filigree, whether implanted ready-made or arranged during the operation, will always stay in place and guard against a recurrence of the hernia, if aseptic healing takes place. In case of suppuration, Bier's hyperæmic treatment with the help of cupping

glasses should be given a thorough trial before resorting to the removal of the wire netting

PAPILLOMATA OF THE BLADDER

DR JOHN F ERDMANN presented a man, 29 years old, who came under his care on November 27, 1906. Eighteen months before, he had noticed, while urinating, that he was passing blood. At certain times it would be almost pure blood, then there were evidences of intermittent bleeding, sometimes just enough to stain the urine, sometimes profound discoloration with clots. There would occasionally be a spasm upon urinating, before the bladder was empty. In the past two months there had been no visible evidence of blood until one week ago, when there was again free hæmaturia. Bloody urine would be induced by jumping on and off cars. He has never had any pain referable to kidney, perineum, bladder or urethra, no thigh nor leg pains. Health otherwise is absolutely perfect. Once he had slight pain in his groin, occasionally has had pain in the lower right side. Never has had any specific disease. He says that the first voiding of blood occurred subsequent to taking a bottle of citrate of magnesia, which was followed by violent catharsis. Urine analysis negative as to kidney cells, casts, etc. He has never had any putrid urine, nor been examined by cystoscope or searches. No loss of flesh. Voids ample quantity of urine. Cystoscopy showed papilloma of very large size, apparently arising from the right side.

Suprapubic operation was done on Thanksgiving Day, 1906. Upon exposing the interior of the bladder it was found that the papilloma arose from a base of one and a half inches in length, and a quarter inch in width, just above and to the right of the right ureteral orifice. The papilloma itself was one that practically filled the entire bladder, and upon extraction readily filled the hand. Removal was made by means of excision and suture of the gap in the mucosa and submucosa. The patient made a recovery in a period of three to four weeks.

DR ERDMANN presented a second case, a man 40 years old, who first visited him in September, 1907, and gave a history of occasional bleeding. The urine varied from a slight evidence, by microscope, to very profound evidence of fresh and disintegrated blood. There were no evidences of pain at any time in his history, his attention being called to the trouble by seeing the dis-

coloration of the urine Cystoscopy showed a papilloma about the size of a filbert near the right ureteral orifice, pedunculated This was removed on September 23, 1907, and barring a phlebitis, both pelvic and saphenous, his convalescence was without further note, the wound in the bladder having healed in fourteen to sixteen days The method of removal was suprapubic, grasping the pedicle in the forceps and excision through the mucosa and sub-mucosa, with final suture

PERINEAL PROSTATECTOMY

DR CHARLES H PECK presented a man, 64 years old, who was in good health up to about two years prior to his operation Since that time he had suffered with increasing frequency of micturition, with tenesmus and a feeling that the bladder had been incompletely emptied He has been obliged to get up many times at night for months past One week before operation acute retention developed for the first time His bladder reached above the umbilicus when first seen by his physician, and about three quarts of urine were withdrawn at one time When first examined by Dr Peck on April 10, 1907, the summit of the bladder was above the umbilicus, and more than two quarts of urine were withdrawn by a catheter, which passed easily Examination by rectum showed marked enlargement of both lateral lobes of the prostate, the upper margin of which could not be reached with the finger For 24 hours on the 11th and 12th of April sixty ounces of urine were drawn every four hours for nearly the entire day (24 hours), the total being 348 ounces Patient drank enormous quantities of water Urine showed a very faint trace of albumin, no sugar, a very few hyaline casts, specific gravity, 1 009, urea, 0 8 per cent ($74\frac{1}{2}$ grams in 24 hours), leucocytes were 14,100, polynuclear cells, 85 per cent, hæmoglobin, 85 per cent, red cells, 5,000,000 Patient was extremely stout weighing about 240 pounds, he was slightly cyanotic, no cardiac murmurs, pulse of increased tension, fair quality

Operation was performed April 13, 1907, under chloroform anæsthesia A median perineal incision was made, and a Young's tractor passed into the bladder The rectum was separated from the prostate by blunt dissection, and division of median bands of tissue with scissors An incision was made through the capsule over the lateral lobe on each side, and six or eight separate

nodules varying in size from a pea to a pecan nut were shelled out with the ungloved finger. Palpation with the finger in each lateral cavity against the retractor in the bladder, and then with the finger in the rectum, demonstrated that the capsule was practically empty, there was no median enlargement. The tractor was then removed and the finger passed through the prostatic urethra to the bladder, there was no obstruction and no stone. A 31 F sound was passed through the urethra to the bladder and a large perineal drainage-tube inserted and secured. Time of operation, 55 minutes.

The kidneys acted freely after the operation, 240 ounces being passed in 24 hours. The tube was removed and a sound passed on the sixth day. Some elevation of temperature followed, and the tube was replaced four days later and left two days more. On May 7th urine began to pass through the urethra, residual urine about 20 ounces. On May 12th, one month after operation, residual urine was 6 to 8 ounces, and the patient was able to hold his urine from 4 to 6 hours. Sounds were passed every 4 or 5 days. Patient left hospital for his home on May 19th, about 5 weeks after his operation. The perineal wound was nearly closed, but a little urine still escaped. One month later he developed a suppurative phlebitis of right leg, which required incision and drainage, and kept him in bed for some weeks. He now has perfect urinary control, there is still a little moisture at the perineal fistula, but only a drop or two of urine escapes at urination. He is able to retain urine 2 to 4 hours, passing he thinks as much as three-quarters of a pint each time.

The case presented some unusual difficulties, *e g*, the great obesity, with poor circulation, and a tendency to cyanosis, increasing the immediate operative and anæsthetic risk, and the high grade of polyuria, which, together with the onset of complete retention, made 'continuous catheterization impracticable, and operation imperative.

CARCINOMA OF RECTUM TEN YEARS AFTER EXTIRPATION OF ADENOMA OF HEPATIC FLEXURE

DR HOWARD LILIENTHAL presented a man of 50 years who was operated on ten years ago for the removal of a tumor of the hepatic flexure which involved the entire ascending colon, part of the transverse colon and six inches of ileum. A resection was

done, and the ileum was anastomosed to the end of the colon by means of a Murphy button. The necessity for the removal of such a large segment of gut was that the ascending cæcum and colon had been drawn up and had become adherent to the adenomatous growth. The patient made an excellent recovery, in spite of his poor general condition at the time of the operation. The excised growth was carefully examined, and proved to be an adenoma.

The patient remained in good health until about one year ago, when he began to complain of pain in the rectum, which was worse on defecation. His stools contained pus and some blood, and there was considerable loss of flesh and strength. Upon examination, Dr. Lilienthal found what he immediately took to be a carcinoma of the anal portion of the rectum, constricting it considerably, and with a number of fissures. A section of the growth removed for microscopic purposes showed adenocarcinoma.

Operation, December 25, 1907. Upon section, the growth was found to extend so high up that it would be impossible to resort to Gersuny's method of twisting the bowel to form a new sphincter after removal of the tumor. The coccyx was removed, and a clamp applied to the rectum about an inch above the tumor, the latter was then pulled down and sewn to the skin, leaving a good-sized opening for drainage. Twelve hours later it was noted that the patient had not passed any urine, and attempts to pass a catheter had failed. This was attributed to accidental injury of the urethra in the course of the operation on the rectum, and before a catheter could be introduced *per urethram* it was found necessary to make a perineal opening pass a catheter from the suprapubic wound through the perineal wound, and insert a sound from the meatus down to the perineal wound. A catheter was then introduced into the bladder through the urethra and left in for ten days. By that time granulations had formed, and the catheter was passed at increasing intervals, and now the patient had no further trouble in passing his urine.

In connection with the rectal operation, Dr. Lilienthal said that in spite of the fact that the ascending colon, part of the transverse colon, and all of his rectum was removed, the patient was still able to hold his stools, although no effort had been made to form a sphincter. By carefully dieting himself and by the

use of subgallate of bismuth, he was able to control his bowels, and had but one passage a day

CRANIOTOMY FOR TUMOR OF ACOUSTIC NERVE

DR WILLY MEYER presented a woman, 23 years old, who was referred to Dr Meyer by Dr George W Jacoby. She had a slight facial palsy on the left side, with drooping of the left eyelid and the corresponding angle of the mouth. She complained chiefly of dizziness and staggering while walking, and swayed on standing. Hearing on the left side was much impaired. There was slight headache, rarely vomiting, choked discs with atrophy.

After careful observation, the case was regarded as one of tumor of the pontocerebellar angle, involving the left auditory and facial nerve, and an operation for its removal was undertaken on January 29, 1908. Preliminary to the operation, the head of the table was elevated, so that the body rested in the inverted Trendelenburg position, with the forehead resting on a special attachment, and hands and feet being supported. Following the suggestion of Dr Dawbarn, blood was stored in both lower extremities for emergency purposes. Anæsthesia was effected by introducing two long tubes through the nostrils, and administering the anæsthetic through a funnel, a mixture of ether, chloroform, and ethyl chloride being used. In the course of the operation, additional narcotization became necessary, and this was given by means of a mask, with the anæsthetist sitting underneath the operating table. Anæsthesia was very satisfactory throughout.

The occiput was exposed through a large horseshoe incision, extending from one mastoid to the other, and reaching about two fingers' width above the occipital protuberance. This flap was then divided into two equal parts and retracted, thus giving a free exposure of the cerebellar region. After trephining with chisel the bone was removed with the rongeur forceps down to the foramen occipitale, this work being greatly facilitated by first thinning the bone with a large curved chisel. At various points, severe venous hemorrhage was encountered from the divided bone, but this was readily controlled by the application of Horsley's wax. Both lateral sinuses were fully exposed, and at last the bridge of bone in the median line cut through with Gigli saw and removed. Now the dura mater was opened and cut parallel with the border of the divided bone on either side near to the

median line Here a double ligature was placed around the longitudinal sinus and the latter divided between A clamp, placed on the distal end, furnished additional security against hemorrhage Now the entire surface of the cerebellum would be widely exposed A pronounced bulging of the cerebellum was noted, palpation of which proved negative An assistant then introduced an angulated brain spatula between the tentorium cerebelli and the cerebellum itself towards the petrous portion of the temporal bone This was followed by a furious hemorrhage (arterial and venous), filling the deep funnel again and again, in spite of the use of tamponades and the local application of adrenalin solution Upon quickly removing the tampon from the cavity, it was seen that the hemorrhage came from the tentorium cerebelli from an artery and vein which evidently connected with the pia mater of the cerebellum, these vessels had been torn in spite of the very gentle introduction of the blunt retractor The hemorrhage was immediately controlled by compression with the gloved finger, the field of operation was perfectly dry Further exploration then revealed a tumor, bluish-white in color and about the size of a cherry, near the meatus auditorius internus, it was hard to the touch, and comparatively easily shelled out in three pieces The surrounding brain tissue was soft to the touch A tampon was left in place to prevent hemorrhage, and a split rubber tube introduced for drainage The dura mater flap was replaced, but would cover only the lower half of the cerebellum, on account of the acute œdema of the latter Injury of the bulging brain by the projecting external occipital protuberance was avoided by gauze tamponade of the latter's roughened border

Subsequent to the operation there was a good deal of oozing of cerebrospinal fluid and for a few days considerable œdema of the face, otherwise recovery was uninterrupted Gradual improvement in the patient's eyesight and other symptoms had taken place since the operation, which was done eight weeks ago

DR GEORGE WOOLSEY said he had operated three times for the removal of neurofibromata of the acoustic nerve—each time with a fatal result In the first case the tumor was removed piecemeal, and the patient, although he apparently did well for a time, died of a small hemorrhage which penetrated the pons In the second case the operation was attempted in two stages, and the patient died after the first stage In the third case the

operation was also done in two stages. In the second stage, on opening the dura, the cerebellum bulged tremendously, so that it was exceedingly difficult to reach the tumor, which had attained considerable size, being about as large as an English walnut. In all these cases, Dr Woolsey said, the ease with which the growth could be removed depended a good deal on its size, and his experience had impressed him with the importance of making a good-sized opening in the skull, in order to secure proper access, and to take care of the protrusion of the cerebellum that usually occurred when the dura was opened. He thought that access to these tumors could best be gained by the removal of a considerable part of the lateral lobe of the cerebellum, and this view was also held and practiced by Mr C. A. Ballance, of London, with whom he had discussed the subject about 2 years ago.

Most of the mechanical contrivances for opening the skull were not very serviceable in operations in this region. If the operation could be done in one stage, that was preferable. The observation of the blood pressure was therefore most important in these cases. The mere relief of intracranial pressure was a most important factor, and that was best accomplished by making a large opening in the skull. This combined with excision of part of the lateral lobe of the cerebellum afforded the best access to the tumor.

DR GEORGE W. JACOBY said that in view of the frequent occurrence of these tumors, particularly those of the acoustic nerve and of the pontocerebellar angle, cases like that reported by Dr Willy Meyer were exceedingly instructive, and emphasized the fact that brain surgery was no longer confined, as had been said, to the motor area. In the majority of cases, these tumors involving a special nerve, such as the acoustic, facial or trigeminal, were rather small and easily enucleated. Clinically, we could usually tell whether we were dealing with a primary tumor of the acoustic nerve, or one originating from the pons, medulla or bone. In the case presented by Dr Meyer there was marked cerebellar gait, with dizziness and almost complete blindness. These symptoms, together with persistent vomiting and headaches, pointed pretty clearly to some growth in the posterior fossa. In addition, there was increasing deafness on one side, with facial paralysis of the peripheral type and the loss of the corneal reflex on the same side indicating involvement of the trigeminal. Upon

these symptoms, the diagnosis of an acoustic nerve tumor was based

DR CHARLES A. ELSBERG said that he personally had had two cases of pontocerebellar acoustic tumors, and in four more cases he had explored the cerebellar region for tumor. In all of his cases the diagnosis of tumor had been made by neurologists. His first patient was operated on in 1905, shortly after Dr. Woolsey had operated on his first case. The patient died on the third day from suppression of urine after the first stage of the operation had been done. The tumor was found in the exact spot where it had been located.

Dr. Elsberg said that after a careful study of these cases he had come to the conclusion that such a wide opening as was advised by Cushing or as was made in the patient shown by Dr. Meyer was unnecessary. If the bone was opened on one side, with free invasion of the corresponding mastoid, a good view of the cerebellum and the pontocerebellar angle could then be obtained by the use of retractors. The speaker said that after working out this method on the cadaver he had learned later that a similar method of approach had been proposed by Krause of Berlin, he had employed it in cutting the auditory nerve in a case of severe tinnitus aurium. The speaker made use of retractors of different sizes, carefully inserted, to draw the cerebellum towards the median line.

In a case which he saw last summer, Dr. Elsberg said, he removed an acoustic nerve tumor about twice the size of an almond. The operation was done in two stages. The patient improved steadily for a time, but ten weeks after the operation he showed symptoms of a recurrence and succumbed suddenly. The postmortem revealed a second tumor—a neuro-fibro-sarcoma lying in the middle fossa, on the base. This second tumor lay in an inaccessible region.

In not a single one of the patients operated upon by the speaker were there any marked respiratory symptoms from pressure on the medulla during the operative manipulations. With a wide opening in the skull and dura and proper care in manipulating the cerebellum, the danger from pressure on the medulla should be a small one. It is neither necessary nor advisable to follow the suggestion of Frazier—*i e*, to excise part of the cerebellar lobe in order to expose the cerebellopontine angle.

DR MEYER, in closing, said the microscopic examination of the growth removed in his case showed fibrosarcoma. The dangers of operation in this region, the speaker said, were largely due to compression of the medulla and pons. By removing a larger section of bone, tying off and dividing the longitudinal sinus and turning down a horseshoe flap of the dura mater, we were in a better position to successfully deal with growths of any size.

CARCINOMA OF THE INNER SIDE OF THE CHEEK, INVOLVING THE ALVEOLAR PROCESS OF THE JAWS AND A PORTION OF THE FLOOR OF THE MOUTH AND HARD PALATE

DR L. W. HOTCHKISS presented a man, 52 years old, who was admitted to Bellevue Hospital on January 1, 1908, with an extensive epithelioma of the right cheek and jaws. His previous history was negative as regards venereal disease and traumatism, but he had been an habitual pipe smoker. His trouble had begun about five months previous to his admission, when he noticed a small ulcer of the mucous membrane of the right cheek at a point which was constantly irritated by being caught between his teeth. This ulcer had steadily increased in size and for the past six weeks had begun to be very painful. The entire side of the face was swollen, the pain increased so as to become unbearable, and the skin of the outer surface of the cheek had become adherent and had finally perforated. Trismus was marked, and any attempt at eating was intensely painful. He could swallow only milk and broths, and opiates were necessary to induce sleep. A section of the growth was examined by the pathologist and pronounced an epithelioma. There was moderate glandular involvement in the submaxillary and superior carotid regions, but no evidence of internal metastasis.

Operation, January 20, 1908. This was necessarily a very extensive one. The growth, together with one-half of the lower jaw and the alveolar process of the upper jaw, and a portion of the malar bone and palate, were removed. The large gap left in the cheek was filled by a plastic flap of corresponding size which had been fashioned at the beginning of the operation. The technic of the method would be described in a paper on the subject by Dr. Hotchkiss which would appear later in the ANNALS

OF SURGERY The patient's condition had steadily improved since the operation, he was able to work and had gained considerable in flesh and strength

ACUTE INTESTINAL OBSTRUCTION, ENTEROSTOMY, RESECTION OF COLON

DR F KAMMERER presented a man of 41, who had suffered for three weeks from occasional griping pains in abdomen, vomiting and obstinate constipation Outside of difficulty in moving his bowels he had not been ill previously, but had noticed a falling off in weight When he came to the hospital he presented symptoms of subacute obstruction, which became acute on the third day Paroxysmal intestinal peristalsis was marked in his case No tumor could be felt Intestinal peristalsis seemed to cease at the cæcum, although the epigastrium was somewhat distended An incision was made over the cæcum, when the enormously distended intestines presented themselves On introducing the hand into the abdomen a constricting tumor was discovered a little below the splenic flexure of the colon An artificial anus was established at the cæcum Several weeks later, with an incision on the left side at the outer border of the rectus, the tumor was excised, followed by an end-to-end suture Finally the artificial anus was closed The case emphasized the difficulties of localizing the area of obstruction, and the advisability of establishing an artificial anus in cases of great distention, when dealing with the chronic variety of intestinal obstruction

SYNCHRONOUS LEFT URETEROSTOMY AND RIGHT NE- PHROSTOMY FOR HYDRONEPHROSIS, DUE TO URE- TER OBSTRUCTION BY BLADDER TUMOR, PERMANENT DRAINAGE

DR F TILDEN BROWN read this paper and presented the patient upon whom the operation was done

DR R HIRAM LOUX, of Philadelphia, said that unfortunately there were a certain number of cases in which some method of draining the kidney must be carried out, either by transplantation of the ureter into the bowel or by some external apparatus About three or four years ago, Dr Loux said, he saw a case of recurrent formation of calculi in the calyces of both kidneys After several operations had been done for their removal the

kidneys became infected and urinary fistulæ formed, necessitating permanent external drainage

DR CHARLES H PECK said that about a year ago he saw a case of complete ureteral obstruction of the right kidney, 48 hours in duration, in a woman whose left kidney had been removed for a partial hydronephrosis. In order to relieve her, a nephrostomy was done and the kidney drained through the cortex. A few days later a ureteral catheter was passed from below, through which the kidney drained perfectly well, but upon its withdrawal the retention recurred. A plastic operation was then done at the junction of the ureter with the pelvis of the kidney but the attempt to re-establish the patency of the ureter failed and a permanent nephrostomy opening had to be left. The urine drained through a rubber catheter which was attached to the thigh. For upwards of a year after this operation the patient remained in good health and was able to attend to her duties. Then she developed some nasal trouble which required operation, this resulted in infection and a fatal meningitis.

BOOK REVIEWS.

ABDOMINAL HERNIA, ITS DIAGNOSIS AND TREATMENT By W B DE GARMO, M D, New York Professor of Special Surgery (Hernia), New York Post-Graduate Medical School and Hospital, Fellow New York Academy of Medicine J B Lippincott Company, Philadelphia and London, 1907

It is to the physician that this book is especially addressed, and it is in order to enable him to diagnose and advise the proper treatment of abdominal hernia that De Garmo has written upon this subject. The work contains an introductory chapter on the surgical anatomy of the inguinal region, there is nothing especially new described here. Inguinal hernia is then taken up, the cause and types are discussed, as well as the symptoms and diagnosis. An important and at the same time unusual chapter is that on the mechanical treatment of inguinal hernia, and it is this which will particularly appeal to the medical practitioner. There are described the various forms of trusses and their mechanism is carefully explained as well as the reasons for failure in some of them. It is interesting to note that it was a medical man who had the honor of having made the most valuable suggestions in the manufacture of the hard rubber truss, with which the names of Riggs, Chase and Hood will always be associated. There follows a chapter on truss-fitting, which most physicians are willing to leave to the truss maker. It is, however, most essential that physicians should understand when a truss fits properly. The physician should be able to write a prescription for a truss as he would for any other kind of treatment. The mechanical treatment of inguinal hernia in infancy and childhood forms another most important chapter. One-half of all the abdominal herniæ occur during the first five years of life, and it is during this period that the defect must be cured if it is ever to be accomplished without operation. It is not a difficult matter and should be thoroughly under the control of the family physician. It is not sufficient for the physician to prescribe a truss for such a patient, he should also regularly inspect the case and make such changes

as are necessary Dr De Garmo instructs us in the management of these cases Works relating to abdominal hernia seldom mention gymnastics as an aid in palliative or curative treatment, but many cases may be improved by their use while others may be enlarged by the improper use of physical exercises There is an interesting chapter on this subject

DISEASES OF THE GENITO-URINARY ORGANS AND THE KIDNEY
By ROBERT H GREENE, M D, Professor of Genito-Urinary Surgery at the Fordham University, New York, and HARLOW BROOKS, M D, Assistant Professor of Pathology, University and Bellevue Hospital Medical School Octavo of 536 pages, profusely illustrated Philadelphia and London W B Saunders Company, 1907

The present volume has been compiled conjointly by a surgeon and a physician It takes up first the general examination of the patient and then the special examinations including the care of urethral instruments and examination of the urine The chapters on cystoscopy show some advance over other of the more recent publications in that the newer American instruments have been described, directions given for their use and for catheterism of the ureters There are chapters on the blood in diseases of the kidney, the ocular manifestations of renal disease, the kidney in acute infectious diseases, Bright's disease and uræmia In reviewing the book as a whole it shows that the medical side of the subject has been more thoroughly discussed than the surgical side, the chapters on Bright's disease, urethritis and prostatitis are more extensive and more comprehensive than are those on the surgery of the kidney and bladder Why authors should continue to classify tuberculosis of the bladder with cystitis it is difficult to understand, tuberculosis of the bladder is as distinct a lesion as is carcinoma of the bladder, and gives rise to many of the same symptoms The disease should occupy a chapter by itself, and the importance of early diagnosis should be emphasized The injection treatment of the disease is the only one advocated Under the consideration of stone in the bladder, the authors tell us that the symptoms closely resemble those of chronic cystitis, the picture, as a rule, is so different, that the description should not go unchallenged, the pain and suffering in many cases is extreme Little reference is made to microscopic examination

of the urine, previous history of stone in the kidney, passage of gravel, and so on. For the relief of this condition—in describing the suprapubic operation—a six-inch vertical incision is advised, in many cases this would bring the incision nearly to the umbilicus and wounding of the peritoneum could not well be avoided. For the instruction of the general practitioner, the book is eminently fitted. The writers are conservative and the clinical material from which they have drawn their experience has been extensive.

ATLAS AND TEXT-BOOK OF HUMAN ANATOMY Volume III
By PROF J SOBOTTA, of Wurzburg Edited, with additions,
by J PLAYFAIR McMURRICH, A M, Ph D, Professor of
Anatomy at the University of Michigan, Ann Arbor With
277 illustrations, mostly in colors W B Saunders Com-
pany, Philadelphia and London, 1907

It is impossible, without actually seeing the volume, to appreciate the beauty and exactness of the illustrations which form a most important part of this work. It is safe to say that it is one of the most extensively illustrated works on anatomy ever published. The third and last volume of this Atlas includes the remainder of the vascular system and the entire nervous system together with the organs of the special senses. In many places the veins and nerves or the arteries and veins have been shown in the same illustration, which is a most important feature in view of the necessity of understanding the exact relations of these structures, it has the advantage that the student using the Atlas in the dissecting-room, can find the great majority of structures in the given dissection shown in a single illustration. The chief aim of the author has been to produce a useful book for the medical student and the physician, and although he does not claim that it appeals to the finished anatomist, still it does that to a greater extent than most of the recent works on anatomy. The text matter has been cut down so as to occupy as little space as possible. Volume I treats of the bones, ligaments, joints and muscles. Volume II of the viscera, including the heart. Volume III of the vascular system, lymphatic system, nervous system, and sense organs. As has been stated above, no one can appreciate the character of the book without reviewing it for himself.

A TREATISE ON FRACTURES AND DISLOCATIONS By LEWIS A STIMSON, B A , M D , Professor of Surgery in Cornell University Medical College, New York New (5th) edition, thoroughly revised Octavo, 847 pages, with 352 engravings and 52 plates Lea Brothers & Co , Philadelphia and New York, 1907

This treatise, which is now in its fifth edition, has been repeatedly reviewed in the ANNALS OF SURGERY, and it is not necessary to mention again at length the character of the work. It is not the work of a novice for Professor Stimson has been devoting himself to the study of fractures and dislocations for many years, and has gained much experience in the Hudson Street Hospital where the traumatic cases practically include all of the various forms of injury which are described in the treatise. Since the Rontgen rays have been introduced and have afforded a more exact method of studying these lesions than was formerly possible, it has been demonstrated that many fractures which seemed to be satisfactorily reduced and adjusted are, in fact, in very poor position, although the functional result is perfect. Although the medical practitioner is loth to assume the responsibility of a complicated fracture, those who are situated far from the great centres must assume this responsibility however limited may be their experience, to these men, especially, the book of Professor Stimson appeals.

A TEXT-BOOK OF MINOR SURGERY By EDWARD MILTON FOOTE, A M , M D , Instructor in Surgery, College of Physicians and Surgeons, Columbia , Lecturer on Surgery, New York Polyclinic Medical School 407 illustrations, pp 713 D Appleton & Co , New York and London 1908

The author in this present work has given to surgical literature a contribution which is notable for its completeness and for the omission of any procedures belonging to major surgery. The book covers those conditions whose description and treatment rarely find sufficient elucidation in Manuals of General Surgery. In reading Dr Foote's work, one can well imagine a morning spent in a large public clinic such as that of the Vanderbilt or Bellevue.

The author has had a vast experience, indeed, from which to draw information. His teaching he has set forth in a clear

terse manner, the text being illustrated by frequent apt and instructive cuts—certainly a relief is experienced on noting their originality. To the young physician who has not had the advantages of a hospital or clinical training, the book will be of special value.

The subject matter is classified regionally into seven sections, affections of the head, neck, trunk, genito-urinary organs, anus and rectum, arm and hand, and the leg and foot. In each section a general schematic arrangement is carried out, thus, for affections of the trunk, he discusses in order, *traumatism*s, including contusions, wounds, sprains, fractures, dislocations, *acute inflammations*, *chronic inflammations*, *neoplasms*, including cystic tumors, solid benign tumors of trunk, solid tumors of breast, malignant tumors of trunk, and *deformities* acquired and congenital. This outline is, of course, varied in other regions of the body where special affections, such as foreign bodies, burns, amputations, etc., may occur, but all parts are treated fully, concisely and exhaustively.

The book concludes with a section devoted to Minor Surgical Technique, considered in three chapters, namely Operative Technique, divided into conditions of operation, treatment of the wound, and some typical operations, the Roller Bandage, sub-divided regionally into general considerations, bandages of head, neck and axilla, alone and in combination, trunk, upper extremity and lower extremity, Surgical Dressings, taking up the questions of textile materials, ligatures and sutures, drains, splints and gypsum applications.

Dr Foote's book is a welcome and valuable contribution to the field of minor surgery, a field which in recent years has been somewhat neglected owing to the wonderful strides made in major surgery.

ORIGINAL MEMOIRS.

THE TREATMENT OF THE UNDESCENDED OR MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA

BY WILLIAM B COLEY, M D,

OF NEW YORK

Surgeon to the General Memorial Hospital, Associate Surgeon to the Hospital
for Ruptured and Crippled

AN undescended testis is not such a very rare complication of hernia, as the statistics at the Hospital for Ruptured and Crippled, as well as those of the London Truss Society show. In 59,235 cases of inguinal hernia in males observed at the Hospital for Ruptured and Crippled from 1890-1907, there were 737 cases of undescended testis.

The basis of the present paper is a study of 126 cases upon which I personally operated. In spite of the fact that the subject has received considerable attention in the last few years (and was the main topic of discussion at the meeting of the French Surgical Society, a year ago) there is by no means unanimity of opinion as to the indications for surgical treatment, and there is also a wide difference of opinion as to the best methods of operation. Furthermore, few large statistics exist in which the after-results of operation are

* Read before the New York Surgical Society, April 22, 1908

stated, and it is with special reference to this point that I trust that my own series may prove of interest

The testis is first placed in the lumbar region, a little to one side of the vertebra, close to the primitive kidney. It descends along the posterior abdominal wall accompanied by or rather following the vaginal process of peritoneum which has preceded it, until it finally reaches the bottom of the scrotum.

In certain cases and due to a variety of causes, its downward progress may be interrupted at almost any point, giving rise to the different types of undescended or maldescended testis. If its progress is stopped before it enters the inguinal canal, it is called abdominal ectopia, if it is stopped within the inguinal canal, it is called inguinal ectopia, if it passes outward to the external canal into the region of the upper scrotum, it is called pubic ectopia.

The varieties thus far mentioned refer only to cases of interruption of the organ in its normal descent. There are cases, however, which, instead of being described as "undescended testis" more properly come under the heading of maldescended testicle, the testicle occupying some abnormal position, *e g*, perineum, Scarpa's triangle, or the aponeurosis of the external oblique, in the region of the anterior superior spine. These different varieties may be designated as inguino-perineal, inguinoperineal, and inguinocrural ectopia.

Perineal ectopia, although described by Hunter in 1786 and afterwards by Curling in 1841, has received very little attention by surgical writers. Curling was the first to give a detailed description of the condition in 1857, and a report of 9 collected cases. He was also the first one to treat the condition by operation. The patient was an infant 4 weeks old. The result of the operation was unfortunate.

Godard in 1857 and 1860 reported two interesting cases, one a man 56 years of age, another of 22. The first case was originally an inguinal ectopia which, after having worn a bandage for a considerable time, became perineal, the second case was cruroscrotal ectopia.

In 1858 Partridge reported a case in which he performed castration. Some years later, James Adams reported the 13th case treated by operation up to that time. The patient died of peritonitis following the operation.

Annandale in 1879 was the first one who reported a case successfully treated by surgical intervention.

Monod and Terrillon in 1889 collected 30 cases of perineal ectopia, which number Weinberger in 1899 increased to 65. Adding to this the more recent cases collected by Klein in his admirable "Thèse de Paris" on Ectopia, we have a total of 81 cases up to this date.

As to the frequency of perineal ectopia, Rennes and Marshall report only 17 cases of ectopia in 14,400 recruits examined for military service, but not one of these is stated to be perineal.

Godard in 53 cases of ectopia found only 3 examples of the perineal variety.

McAdam Eccles in his work on the imperfectly descended testis states that out of 936 instances of imperfect descent of the testis, associated with hernia, only 5 were found to be of the perineal variety.

My own statistics show 9 examples of perineal ectopia in 126 cases of hernia with undescended or maldescended testis operated upon.

At the Hospital for Ruptured and Crippled there have been observed during the past 18 years 737 cases of undescended testis, and of these only 15 were of the perineal type. In 6 no operation was performed.

As regards the age of the patients, while the disease is of congenital origin, the testis is not always found in the perineum at birth. In certain cases it is situated just outside of the inguinal ring, or has passed below the pubic bone, and later on reaches the perineum. In practically all of my own cases the testis had always been present in the perineum, as far as was known. In the great majority of cases the condition is unilateral.

Hutchinson has reported one case in which both testicles

in a total of 2200 operations for hernia of all varieties were in the perineum, and Ammon has published a second such case

Heredity—Godard mentions a case in which the condition occurred in father and son, and Klein reports a case in which the brother of a patient had multiple dystrophies, particularly hypospadias

Etiology—Authorities differ widely as to the precise cause of descent of the testis into the perineum. Until recently there was a tendency to accept fully the opinion of Curling that had become almost classic, that the principal and almost only agent connected with the descent of the testis was the gubernaculum, and as the latter was admitted to have several fasciculi, one attached to the lower part of the scrotum another extending into the perineum to the margin of the ischium and a third into the pubic or femoral region, this seemed an easy and sufficient way of accounting for the different types of maldescent of the testis. In the perineal variety the fibres were supposed to be more fully developed than in the inguinal type, and by traction the testicle became lodged in this region.

Godard accepted the theory fully and believed nothing more simple than this explanation,—no gubernaculum and the testis remains within the abdomen, no middle fasciculus, and inguinal ectopia occurs, while in the event of the anomalous insertion of the fasciculus either in Scarpa's triangle or the ischium, we have cruroscrotal and perineal ectopia.

However, Bramann, in 1884, made a very careful study of 40 human embryos with special reference to the migration of the testicle, and as a result of these investigations declared that he had never been able to determine that the vaginal sac divides the fibres of the gubernaculum as it becomes inserted in the bottom of the scrotum.

Lockwood, in 1887, made one of the most careful anatomical studies of the undescended testis that has ever been made, and proved anew the plurality of the inferior insertions of the gubernaculum, and showed that during the 6th and 7th

month the fibres of the latter penetrate the inferior portion of the abdominal wall and extend into the triangle of Scarpa, others are attached to the pubis and root of the penis; others again extend behind the scrotum, in the 8th month, as dissections have shown, many of the inferior fibres of the gubernaculum pass into the peritoneum ending in the tuberosity of the ischium or become one with the sphincter ani

Lockwood believes the gubernaculum the main factor in the descent of the testes, and attributes the various types of maldescent to over-development of portions of the gubernaculum lying in these particular regions. He states "The muscular structure of the gubernaculum is, I think, unquestionable, and it seems irrational to deny its tissues their function, namely, that of traction." He regards it of special significance that in case of maldescent, the testicle migrates into particular regions in which, as has been well established, the fibres of the gubernaculum exist. I do not believe that Lockwood's argument is entirely convincing.

Latei, Sébilleau, after careful personal research upon the coverings of the testicle and its migration, concludes that "perineal ectopia is a purely congenital affair. It depends neither upon pathological nor anatomical causes and least of all upon the gubernaculum." He recognizes that the absence or insufficient development of the gubernaculum may explain abdominal and iliac retention. As regards the inguinal and extra-inguinal, he believes that the abdominal wall itself plays a very real and important rôle in offering difficulty to the complete passage of the testicle through the external ring.

Championniere in his "clinical lecture on anomalies of the testicle," gives the result of 44 operations in 39 patients. He strongly opposes the theory of the gubernacular origin of the undescended testis and says that only a physiology as legendary as that which, in former times, accepted multiple testes as proven facts, can seek to explain the descent of the testis by a legendary origin of the gubernaculum testis. The defects of the gubernaculum are invoked as a cause of non-descent and, quite naturally, these writers seek to supply its deficient

action by traction made upon the testicle either in the direction of the scrotum or in the direction of the thigh by structures more or less doubtful Without discussing this, as he terms it, childish theory of the gubernaculum testis, Championniere states that we must admit that we do not know the cause of this descent We can, however, generally affirm that we do know certain conditions which hinder it

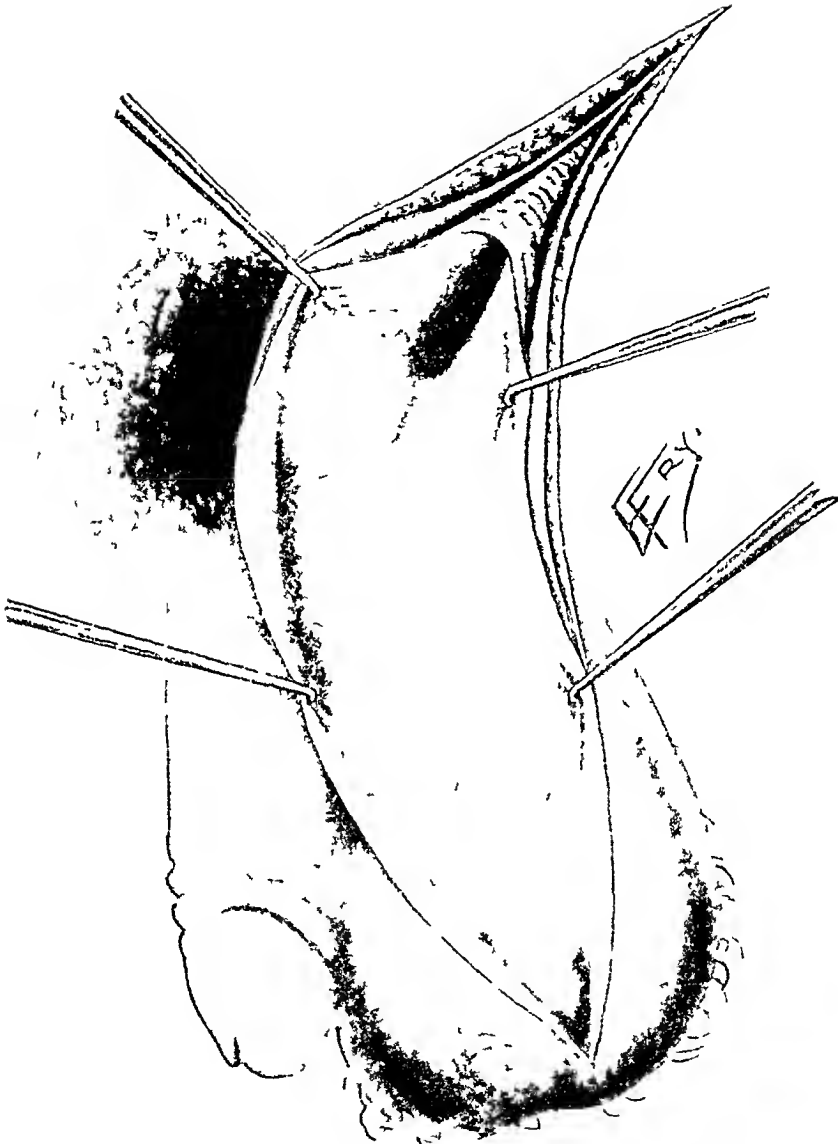
Championniere concludes from his observations that an ectopic testicle should always be preserved for the reason that, although it may have no functional value, it has an important influence upon the general health and virility of the subject His own series of cases however shows that in 15 cases the testicle was sacrificed and in 19 cases orchidopexy was performed

Among the chief reasons which have influenced Championniere as well as others to sacrifice the testicle, has been the idea that by so doing a radical cure of the accompanying hernia would be more certainly effected However, Championniere's own statistics as well as those of other men, have shown that the herniæ remained cured in practically all cases without regard to whether or not the testicle has been removed Hence, such reason for orchidectomy no longer obtains

Championniere believes that a hernia practically always accompanies ectopia of the testicle of whatever variety and adds that although he performed two operations for ectopia without finding a hernia, one of these was an old operation and his not finding the hernial sac may have been due to inexperience My own experience is entirely in harmony with this view In not a single case of my entire series, 126 in number, did I fail to find a hernial sac

Budinger, one of the most recent writers upon the etiology of the undescended testis, states that he has operated upon 24 cases of inguinal retention of the testicle and that mechanical obstruction of some sort was found to be the cause of the nondescent of the testicle in 15 of these cases A certain number of anatomical investigations upon cadavers confirmed the result

FIG 1



Rare type of undescended testis with hernial sac and cord extending to bottom of scrotum. Testis arrested at external ring

One of the latter, a man 40 years of age, was brought to the hospital with cryptogenic pyæmia of which he died. Autopsy revealed the following conditions. The connective tissue of the scrotum proved absolutely normal, the hernial sac and tunica vaginalis propria were found loosely embedded, nowhere was there a structure that could in any way be brought in connection with a gubernaculum. The tunica vaginalis propria was greatly thickened, the sac elongated upward into the shape of a diverticulum. A band extended from the upper portion of the tunica vaginalis along the outer side of the testicle and epididymis, in its lower portion becoming one, partly with the tunica vaginalis, partly with the epididymis.

Budinger states that while cicatricial adhesions between testicle and epididymis and intestines are given as one of the causes of retention by all authors, his experience has shown him that, though often seen, these phenomena are much less frequent than those peritoneal changes which, while having no direct connection with the gland, nevertheless interfere in an unequivocal manner with the motility of the testicle. He believes the adhesions of the testicle itself to represent an accidental localization of an extensive inflammatory process, rather than a cause in itself of the retention of the organ, and that cicatricial retraction of the peritoneum after inflammatory processes that take place prenatally or in earliest infancy, in the neighborhood of the inguinal canal, using up large areas of peritoneal covering, are a far more frequent cause of retention of the testicle. An undescended testis may prove an abnormally long cord, as shown by Fig. 1.

One of the most valuable of recent contributions to our knowledge of the undescended testis is the paper by Odiorne and Simmons (*ANNALS OF SURGERY*, Dec., 1904). This paper is based upon a careful study of 77 cases observed at the Massachusetts General Hospital from 1877 to 1904. Inasmuch as orchidectomy was frequently employed, the microscopical study of the testicles removed has added considerable to our knowledge of the pathology of the undescended testis. It was shown that the tunica albuginea was more or less thickened in all the specimens examined, two being "five times thicker than the normal organ," and the interlobular connective tissue, while varying in amount, was generally increased. One of the most striking features of the unde-

scended testis was the "interstitial cells," which were found in all cases and generally in large numbers. These cells, while present in children in whom the testicles have normally descended, are not found in the adult organ. Their function is largely a matter of conjecture. According to Monod and Arthaud they are more often seen in the neighborhood of blood vessels. The specimens described by Odiorne and Simmons exhibited no definite relation to any structure of the testis, they were endothelial in type and of large size, with rounded nuclei.

The undescended testis shows another variation from the normal in the thickening of the basement membrane of the tubules. The epithelial lining of the tubules also shows very marked changes, the epithelial cells being few in number and more or less degenerated and irregular in shape. The so-called Reinke¹ crystals are usually seen in the interstitial fibrous tissues of the undescended testis. The nature and function of these crystals has as yet not been fully determined.

As regards treatment, no uniform method was employed, as the 77 cases were under the care of 15 different surgeons during the period of 27 years. In 28 cases orchidectomy was practised. Of these 17 were performed since 1900, 5 of which were in children, *ie*, in cases under 16 years of age. In four cases the testis was reduced into the abdominal cavity. In only 18 cases, 11 adults and 7 children, between 5 and 13 years of age, was orchidopexy performed, or an attempt made to bring the testis into the scrotum.

A perfect result was obtained in only 2 instances of the 7 children, this was in a patient with double retention, in 2 others the result was satisfactory, the testicle having remained in the upper portion of the scrotum. Of the 11 operations done upon adults between 16 and 42 years, 5 remained in the scrotum, one in perfect position, three retracted soon after operation into the canal, where they remained much atrophied, one is the cause of considerable pain. Two retracted into the

¹ Arch f mikr Anatomie, 1896, p 34

pubic region, where they were the source of considerable annoyance, owing to their position

This analysis suffices to prove that at present there is no definitely settled procedure of dealing with the undescended testis. There is agreement neither as to the proper age of interference nor as to the method of operation.

For many years—a century or more—it has been an almost universally accepted opinion that the undescended testis is peculiarly liable to undergo sarcomatous degeneration (Hunter, Godard, Curling)

McAdam Eccles (1903 Jacksonian Prize Essay) was the first to seriously question this opinion. He stated that close examination of upwards of 48,000 males with hernia, at the London Truss Society showed 854 cases of imperfectly descended testis, or about 2 per cent. In this series there was not a single example of sarcoma of the undescended testis. Furthermore, in 40 cases of sarcoma of the testis observed in one of the large London hospitals during a period of 20 years, there was only one case of sarcoma of the undescended testis. From these and other facts, he concluded that the generally accepted opinion could not be substantiated.

Since the publication of McAdam Eccles' paper, Odiorne and Simmons (*ANNALS OF SURGERY*, Dec., 1904) incline to accept the older opinion, in favor of which they cite 54 cases of malignant disease of the testis observed at the Massachusetts General Hospital during a period of 26 years. Of these 6, or 11 per cent occurred in the undescended testis. They further state that Schodel, quoted by Von Kahliden, has reported 41 cases of sarcoma of the testis observed in a large London hospital in one year, of which 5, or 12 per cent occurred in the undescended testis. This latter statement is clearly incorrect, since sarcoma of the testis is too rare a condition to be observed 41 times in a single hospital in one year.

McAdam Eccles states that among 4,200 male patients admitted annually to a large London hospital, there has been only an average of 2 cases of sarcoma of the testis during a period of 20 years.

Our observations at the Hospital for Ruptured and Crippled are quite in harmony with the facts related by McAdam Eccles. Since 1890 59,235 cases of hernia in males have been observed, in only 737 of which an undescended or maldescended testis was found, and not a single case of sarcoma of the undescended testis.

Personally, I have observed 34 cases of sarcoma of the testicle. The first 25 all occurred in normally descended testes, in the 26th and 27th and 34th cases the sarcoma developed in an undescended testis, all were examples of abdominal ectopia. This would make 8.8 per cent of sarcomas of the testis originating in the undescended organ.

While the facts submitted by Eccles as well as the statistics at the Hospital for Ruptured and Crippled do not fully justify his conclusion (for the reason that a patient with a sarcoma of the undescended testis would not necessarily go to a hernia clinic, but to a general hospital) it is probably true that the danger of the undescended testis from the development of sarcoma is much less than has generally been supposed. It should be noted that the danger is much greater in abdominal than in the other varieties of ectopia.

Many surgeons have advised operation in the very young children, *e g*, 2 years of age or even younger. Such practice ignores the fact that in a large proportion of cases of undescended testis in young children, the organ will reach the scrotum by the age of puberty without surgical interference. In just what proportion of patients the undescended testis finally reaches the scrotum, has never been determined, I am at present engaged in tracing a large series of non-operated cases observed from 5 to 15 years ago.

That this is true is shown by the study of the statistics of any large hernia clinic. Of 739 cases of undescended testis observed at the Hospital for Ruptured and Crippled, since 1890, 561 occurred in 18,410 children under the age of 14 years, or 3 per cent, while only 92 cases occurred in 3,848 between the ages of 14 and 21 years, or 2.2 per cent, and only 75 cases in 37,370 over 21 years of age, or .2 per cent.

That is, under the age of 14 years undescended testis is 15 times more frequent than after the age of 21 years

Inasmuch as only comparatively few cases have been cured by operation during this period, the only conclusion is that the majority of undescended testes seen in infancy and early childhood eventually reach the scrotum through natural causes before the age of 14 years. Still another reason for deferring operation is the fact that the results of operations performed between the ages of 12 and 14 years are far better than those of an earlier age. One reason advanced in favor of early operation is that hernia associated with undescended testis is far more liable to strangulation. This assumption I believe to be incorrect, and not supported by facts. We have never observed a case of strangulation of a hernia with undescended testis at the Hospital for Ruptured and Crippled.

The results of the treatment of the undescended testis in France, as brought out at the Congress of Surgery in 1906, were as follows.

Villard reported 116 operations, with 56 perfect results, 42 doubtful ones and 18 failures. He stated that as a result of operation there is usually decrease of pain and increase of the virility of the individual, but the influence upon spermatogenesis is practically nil.

Kermisson, of Paris, reported 80 operations for undescended testis from 1898 to 1905, without any serious complications. Thirty-nine were examined as regards late results. Of these the testis was found in the scrotum in 15 cases, in ten at the root of the scrotum, in 9 at the orifice of the inguinal canal. In 2 or 3 cases only was the testicle well developed. In 10 cases associated with hernia, Bassini's operation was performed.

De Page reported 20 cases, of which 5 were double. Ten were traced, and in 7 of these the testicle was found in its normal position, in three others the testicle had retracted toward the external ring.

As regards the indication for operation, Villard would

not operate upon the abdominal variety of ectopic testis, for the reason that the operation is dangerous and the result uncertain. In simple cases, not complicated with hernia, he advised non-interference under the age of 10 years, and then closing the canal by Bassini's method.

While some of the surgeons advised operation in childhood as early as the second or third year, *e g*, Girard, the weight of opinion was in favor of postponing the operation until at least the fifth or sixth year and some until the age of ten, *e g*, Villard and Keimisson.

Bioca's results still remain the most complete and most comprehensive (Bulletin Soc de Chir 28, 1902, p 761). He reported 138 operations for inguinal ectopia associated with hernia, all cases occurring in children. Sixty-two patients with 79 operations were examined at periods of one year and upward after operation. Thirty-one showed perfect results, 35 fairly good results. Thirteen cases may be classed as failures as regards the testis remaining in position, although there was no return of the hernia. In all of these cases the testis showed more or less atrophy and in most of the cases the atrophied testis had retracted to the neighborhood of the external ring, or in some cases into the canal itself.

METHODS OF OPERATION

The various methods of operation may be classified as follows: (1) Freeing the testicle and cord, with suture of the testis to the scrotum itself (Wood, Nicoladoni, Horsley), (2) freeing the testicle and anchoring it to the testis on the opposite side (Tuffier, Championniere, Sébilleau), (3) cutting away all the structures of the cord except the vas and its vessel, then anchoring the testicle in the scrotum by placing the testis in the scrotum with or without suture (Mignon and Bevan). Suturing the cord to the tissues forming the external ring (Rieffel).

A number of other methods have been proposed, though not extensively followed, *e g*, pushing the testicle through an opening in the scrotum and burying it in the tissues of the

thigh temporarily, later returning it to the scrotal cavity (Keetley) Most surgeons, with the exception of Broca, close the inguinal canal by Bassini's method Bevan was one of the first to recognize the disadvantages of this method of closure, inasmuch as a gain in length of the cord of $\frac{1}{2}$ –1 in or more may be obtained by not transplanting the cord, bringing it out at the lower angle of the wound (modified Bassini).

The method of operation which I have employed has been Bassini's incision, freely opening the aponeurosis of the external oblique as high up as possible, surrounding the cord and hernial sac, which latter has always been found present Grasp the lower portion of the tunica vaginalis and by traction bring the testicle as far down as possible Next, separate the sac from the cord, high up, just outside the internal ring (In children this requires very careful and delicate dissection, as the cord is usually greatly enlarged and spreads out in a fan-like manner over an area of the sac 1–2 in in size) If the dissection has been begun at the right layer, the sac can be isolated and is then tied off as high as possible In most cases of inguinal retention the cord can then be freed sufficiently to permit the testicle to be brought at least into the upper portion of the scrotum, in most cases into the lower part, with the sacrifice of but few, if any, of the veins Except in a very few of the early cases, I have never made any attempt to anchor the testis in the scrotum, but rely upon careful freeing of the cord high up Suturing of the testicle within the scrotum is, in my opinion, of little value If there is any tension, the scrotum is retracted up toward the external ring The canal is then closed by the modified Bassini method, *i e*, the cord is brought out at the lower end of the wound, the internal oblique is then sutured to Poupart's ligament over the cord Great care is taken in placing the lowermost suture, which should include the reflected portion of the external oblique as well as the conjoined tendon and Poupart's ligament on the outer side This suture, when tied, makes but a very small external ring, too small ever to permit the testis to retract into the canal, even should it reach the ring

Bevan in 1899 and later in 1903 (Jour Am Med Ass'n) described a new method of operation for the undescended testis and strongly urged the more general employment of surgical treatment for this condition. His method consists in brief in a free opening of the canal by Bassini's incision of the skin and aponeurosis, cutting off the hernial sac high up beyond the internal ring, cutting away all the fascia and muscular fibres that hold the cord and testicle fixed in the canal, passing the finger into the iliac fossa and stripping the vas deferens from the peritoneum by means of blunt dissection, even sacrificing the veins and spermatic artery, if necessary to secure sufficient motility of the testis, to permit of its being brought into the scrotum without suture. The canal is then closed by the modified Bassini method, without transplantation of the cord. The external ring is carefully sutured to prevent the testicle from again entering the canal, should retraction take place.

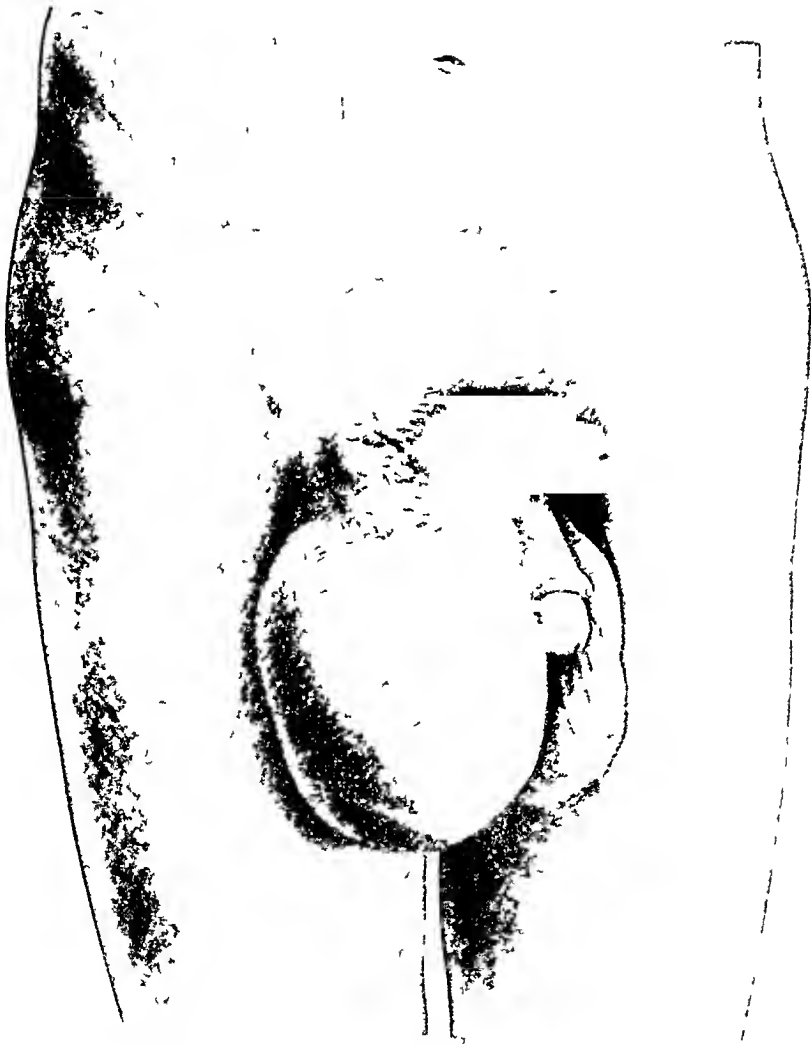
Up to 1903 Bevan had operated upon 20 cases, although the late results of these cases are not given. He advises operation in all cases in which the testis can be palpated and believes the most favorable age of operation to be between the sixth and twelfth year.

CASES OF MALDESCENDED HERNIA OF SPECIAL INTEREST

(A) *Inguinoperineal Hernia*

CASE I—J M, aged 27 years, congenital, right side. Operation in 1895, at the Post-Graduate Hospital. A tumor the size of a child's head occupied a large pouch made of the dilated skin of the peritoneum and extended to the margin of the anus (Fig 2). The right scrotum was empty and atrophied, testicle at the bottom of the hernial sac. A regular Bassini incision was made and the pouch found to contain small intestine omentum and the testis. On reduction of the contents, the testis was found at the bottom of the sac in the peritoneum and greatly atrophied. The testis and cord were removed and the wound closed by Bassini's method. No relapse of the hernia one year later, at which time the patient was drowned.

FIG 2



Inguinoperitoneal hernia (case I) from photo

FIG 3



Inguinoperineal hernia (Case VI)

CASE II—W G, aged 17 years, congenital, right inguinal hernia with perineal ectopia Operation in 1901 at the General Memorial Hospital The hernial sac was found to communicate with the abdominal cavity and, at the bottom of this, in the perineum about one inch from the margin of the anus, was the testis, almost normal in size The regular Bassini incision was made in this case as in the preceding and the upper portion of the sac was removed and tied off flush with the abdominal cavity, a sufficient amount of the lower portion was left to furnish a new and complete covering to the testicle, it was united with purse-string suture The testis was then transplanted into a pouch in the scrotum made by digital dilatation Examination six years later showed the testis occupying a normal position in the scrotum and normal in size

CASE III—A S, aged 35 years The patient had noticed the hernia for only six years and had worn a truss the entire time Operation July, 1896 The right scrotum was found to be empty and the testis which was atrophied to half normal size, was found in the anterior portion of the perineum In this case the testis was not transplanted into the scrotum, wound closed by Bassini's method Examination 5 years later showed the testis still occupying the anterior perineal region, no further atrophied

CASE IV—Infant, aged 7 months; left inguinoperineal hernia, sliding hernia of the sigmoid Operation was undertaken at this early age for the reason that it was impossible to control the hernia by any form of truss The operation was done at the Hospital for Ruptured and Crippled in Jan, 1908 The testis was found in the mid-perineum and normal in size, it was transplanted into the scrotum The hernia was reduced and the wound closed by Bassini's method

CASE V—W C, 16 years of age, had noticed a swelling in the right groin since a few days only Physical examination shows the testis in the right mid-perineal region, a hernia in the canal, which, however, does not enter the perineal region Operation Aug 27, 1896, at the Post-Graduate Hospital Bassini's incision for inguinal hernia A small hernia sac is found extending down nearly to, but not communicating with the tunica vaginalis, which contained some bloody fluid in its cavity The testis was found occupying the mid-perineal region and could be

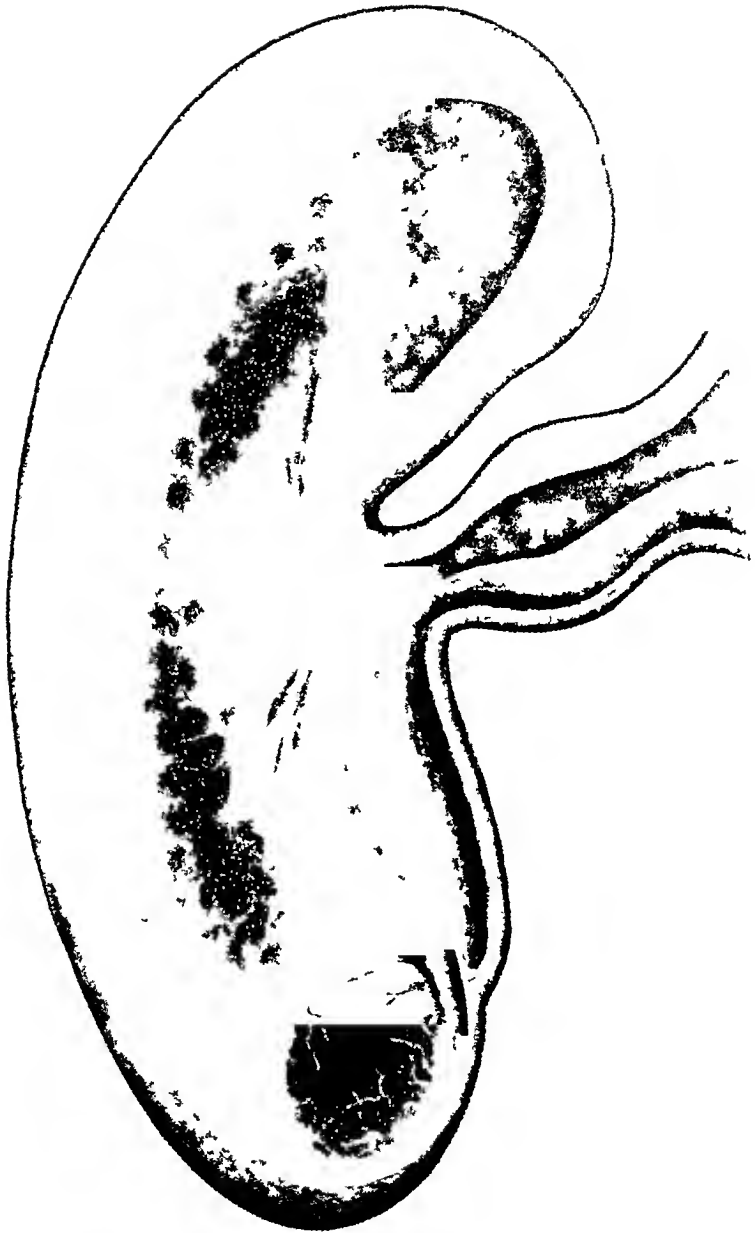
pushed back almost to the anal margin. The right scrotum was empty and flat, the testicle and tunica vaginalis were dissected out from the perineum and transplanted into the scrotum in normal position. The inguinal canal was closed by Bassini's method. Examination 4 months later showed the testis of normal size, in the bottom of the scrotum.

CASE VI—A D, aged 29 years, admitted to the General Memorial Hospital in April, 1907, with a history of having had a swelling in the right mid-perineal region since childhood, which had given him considerable trouble of late in sitting and walking, the right scrotum had always been empty. Examination showed the right testicle occupying the mid-perineal region with the physical signs of an inguinal hernia passing down to the region of the testis (Fig 3). Operation was performed in April, 1907. The testis was found to be normal in size, the hernial sac which communicated with the tunica vaginalis, was removed high up. Sufficient peritoneum was left to make a complete covering for the testis. The testis and cord were then transplanted into a pouch made by manual dilatation in the right scrotum. The wound was closed by the modified Bassini method, not transplanting the cord. The patient came to see me again in October. Examination at this time showed the testis had again retracted into the perineal region. I did a second operation, without opening the inguinal canal, brought the testis to the bottom of the scrotum and there sutured it with catgut. The testis has remained in perfect position since, the last examination having been made on March 28, 1908, six months later.

CASE VII—T E, aged 40 years. Right inguinoperineal hernia since infancy. Operation General Memorial Hospital, 1902. Testis transplanted into scrotum. Hernia wound closed by modified Bassini operation. Examination 5 years later showed testis in normal position. Testis slightly atrophied at time of operation, no further atrophy.

CASE VIII—M H, aged 5 years. Left inguinoperineal hernia. Operation Hospital for Ruptured and Crippled, November 15, 1895. Testis found in anterior portion of perineum, with hernial sac communicating with tunica vaginalis. Testis transplanted into scrotum. Wound closed by Bassini's method. Examination 8 years later showed testis in normal position, no atrophy.

FIG. 4



CASE X Inguinosuperficial hernia with blue discoloration. Strangulated contents.
No hernia noticeable prior to strangulation.

CASE IX —F E, aged 40 years, had noticed swelling in the right perineal region since childhood. Operation at the General Memorial Hospital Oct 1, 1902. Bassini's incision for inguinal hernia. The right testis was found in the mid-perineal region, the tunica vaginalis communicating with a large hernial sac which contained a mass of irreducible omentum. This was tied off in small sections and the stump reduced into the abdominal cavity. The testicle was transplanted into the right scrotum. Examination May 6, 1907, showed the result perfect.

In addition to the preceding cases, I have observed at the Hospital for Ruptured and Crippled since 1890, six other cases of perineal ectopia which were not operated upon. Whether or not the ectopia was associated with a hernia could not be determined without operation. One, aged 5 years, left side, another aged 21 months, right, a third aged 7 months right side. The other three cases were in adults.

(B) *Inguinosuperficial Hernia With Undescended Testis*

CASE X —*Inguinosuperficial hernia with bilocular sac* —That a diverticulum of peritoneum or hernial sac may occupy an unusual position irrespective of the action of the gubernaculum, is illustrated by the following case.

L N, aged 30 years, was operated upon at the Post-Graduate Hospital, Feb 25, 1897, for strangulated omental hernia of large size. The patient gave a history of having had no hernia nor even impulse on coughing prior to 24 hours before admission. While engaged in dancing a tumor appeared in the left iliac and scrotal region, about the size of a fist. It was very painful and could not be reduced. Nausea and occasional attacks of vomiting followed, but there was a small movement of the bowels. Physical examination showed a tumor occupying the upper scrotal region, extending up over the aponeurosis of the external oblique as far as the anterior superior spine. The whole tumor was completely dull on percussion. The diagnosis of strangulated omental hernia was made and immediate operation advised. On cutting through the skin a tumor was found emerging from the external ring, which was very tightly constricted and composed of two loculi, one passing down into the upper scrotum, the other upward, resting upon the aponeurosis of the external oblique. The

canal was first opened and then the sac, which was found to contain a large mass of deeply congested omentum, with several ounces of bloody serum, no intestine was present (Fig 4) The testis was found to occupy the lower portion of the bilocular sac, the upper one containing only the imprisoned omentum The patient made an uninterrupted recovery

In this case we undoubtedly had to deal with a bilocular sac of congenital origin which had been entirely empty up to 24 hours prior to operation, when a mass of omentum was forced into the sac The old explanation of such sacs being due to the gradual dilatation of a hernia prevented from passing downward by the testis, and following the line of least resistance upward, does not hold good in this case

The recent investigations made by Murray, of Liverpool, who has examined 200 cadavers of adults who had had no history of hernia during life, showed that congenital diverticuli are by no means infrequently found in the femoral canal, he having found 47 such instances in the above series of examinations

These facts, I think, enable us to explain perineal ectopia as well as the inguinoperitoneal variety, as the result of an unusual prolongation of a peritoneal diverticulum, rather than the result of traction of a more or less imaginary fasciculus of the gubernaculum

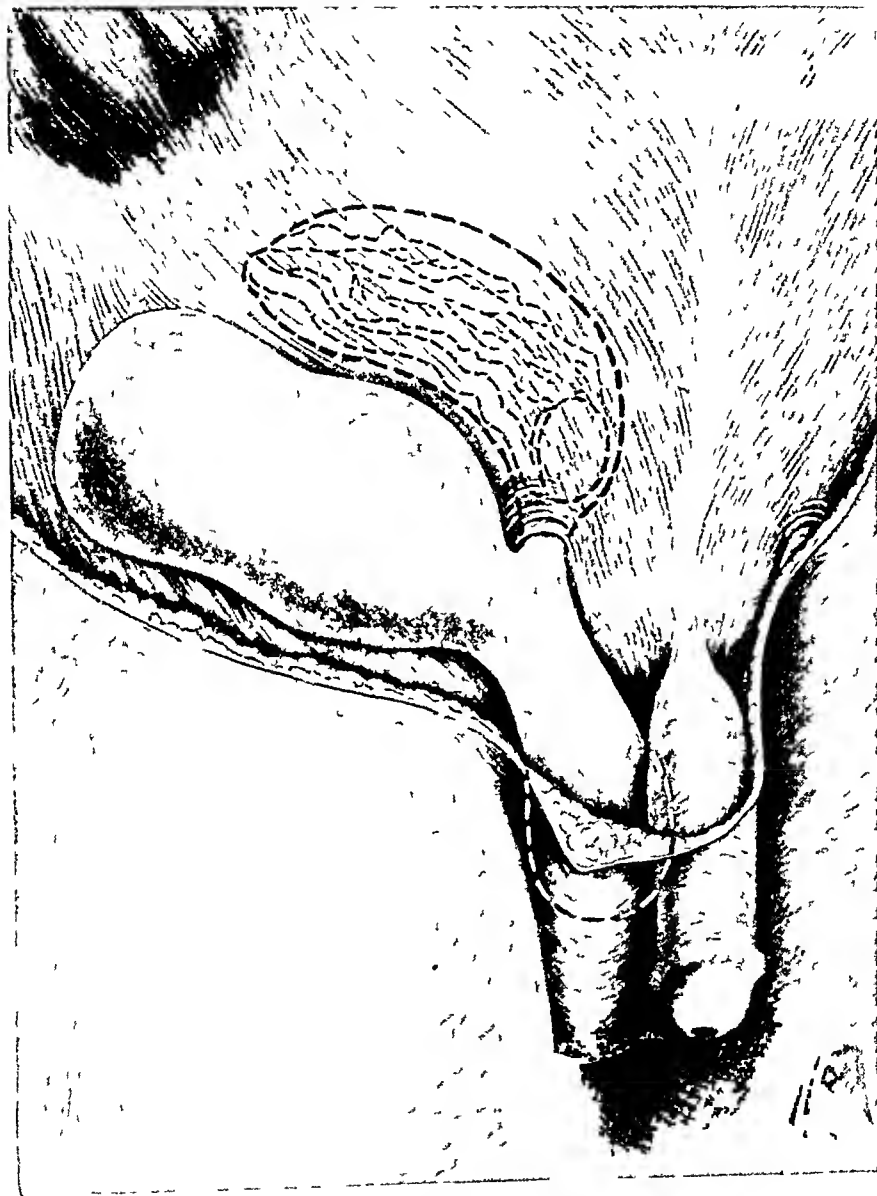
CASE XI—*Inguinosuperficial hernia with trilocular sac*—A H, 24 years of age, right undescended testis with right inguinoperitoneal hernia The patient gives a history of the testis never having been felt on the right side, a swelling having been noticed for a number of years, often disappearing on lying down Operation March 1, 1908, at the General Memorial Hospital On making the usual incision for Bassini's operation for inguinal hernia, cutting through the skin and superficial fascia, an empty sac was found resting upon the aponeurosis of the external oblique, and extending nearly to the anterior superior spine The right scrotum was empty and the external ring small On splitting up the aponeurosis of the external oblique, a second interstitial sac was felt situated between the external and internal oblique, about $2\frac{1}{2}$ in in diameter At

FIG 5



Inguinosaphic hernia Bilocular sac with testis up to or

FIG 6



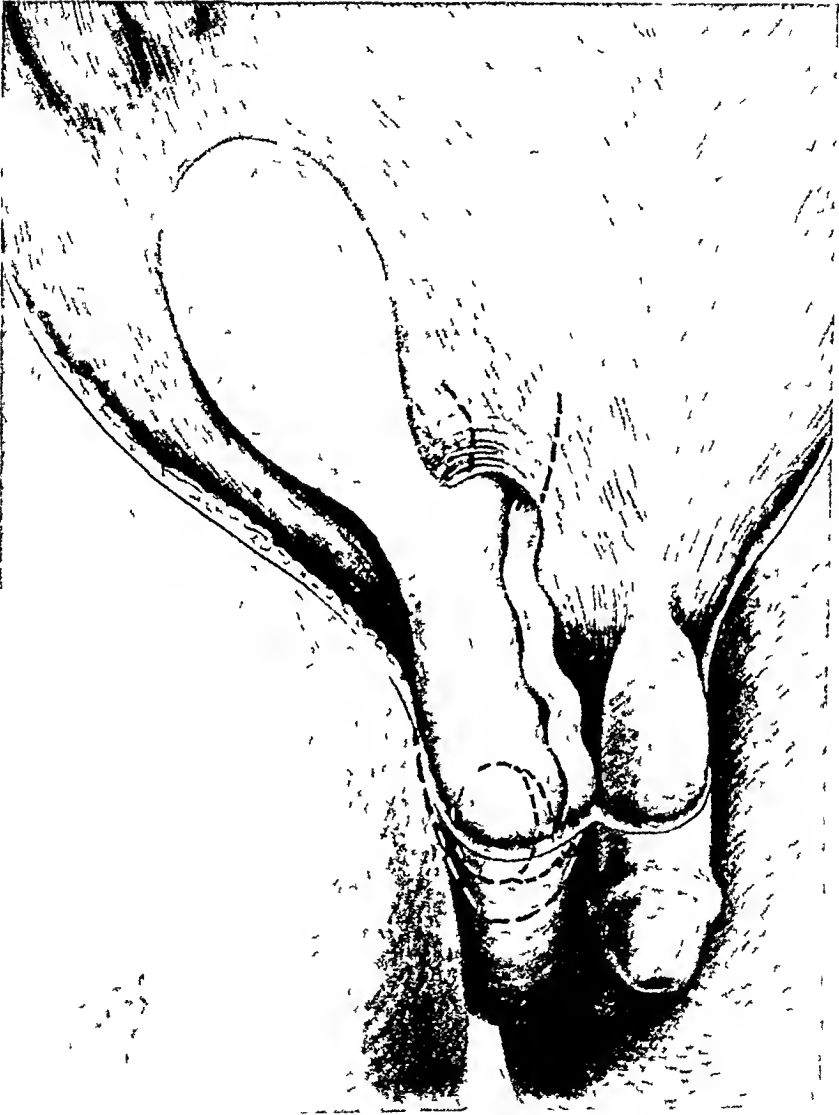
Inguinosuperficial and interstitial hernia with trilocular sac

FIG 7



Inguinosuprarenal hernia From photo

FIG 8



Inguinosuperficial hernia Testis in upper scrotum

the bottom of this sac, resting on the transversalis muscle and attached to the pubic bone, the testis was found. It was somewhat atrophied, being about two-thirds normal size. The internal ring was rather small and did not permit of the return of the testis into the abdominal cavity. There was still a third loculus of the sac communicating with the external and internal loculi and occupying the upper part of the scrotum (Fig 6). This was empty. A portion of omentum, about 3 in long, about the size of the little finger occupied the inner sac and at its distal end was adherent to the testis. This was removed. The peritoneum was tied off well above the internal ring and sufficient left to make a perfect covering for the testis. The cord was thoroughly freed and the testis brought into the lower part of the scrotum without much tension. The wound was closed by the modified Bassini method, without transplanting the cord.

The inguinoperitoneal variety of hernia (Figs 7 and 8) has been regarded as an extremely rare type. Moschcowitz (Med Rec Vol LXIII, p 62, 1903) in reporting a case, stated that only 17 were recorded in the literature.

This type of hernia has already been described by Macready and Kuster, and up to recently, very few cases have been reported. That the condition is much more common than has been recognized, is shown by the statistics at the Hospital for Ruptured and Crippled, as well as by my own cases operated upon elsewhere. Personally I have operated upon 25 cases, 10 adults and 15 children. The adults were between 16 and 33 years of age, the children between 5 and 13 years. In all but two cases the testis was either found in the superficial sac resting on the aponeurosis of the external oblique, or it could be made to enter this sac on coughing. In 2 cases, already referred to, the testis had evidently never occupied the external sac (vide Case X).

This type of ectopia I believe to be due to the fact that the vaginal process of the peritoneum has, for some unknown reason been turned upward upon the external oblique instead of taking its normal course into the scrotum.

The treatment of this variety of maldescended testis is extremely satisfactory, for the reason that in most cases the cord is sufficiently long to enable the operator to bring the testis into the scrotum with little or no tension

CASE XII—*Unusual type of abdominal ectopia* (see Fig 9) The patient, aged 17 years, with double undescended testis, was operated on April 18, 1908, at the General Memorial Hospital On palpation it was thought that an atrophied testis could be felt on the right side, but operation showed an empty vaginal process extending into the scrotum The bottom of this process was thickened into folds which gave the feeling of an atrophied testis On the outside of the vaginal process or sac, posteriorly, exactly corresponding to the cord and its vessels in the normal condition, there were a number of vessels, arteries and veins which made up a false cord These vessels became lost at the bottom of the sac The testis itself, fully developed, was found in the abdominal cavity, was brought out and by carefully freeing the peritoneal and muscular bands was brought into the bottom of the scrotum

ANALYSIS OF CASES

This series of cases comprises 128 operations Of these 25 represented an ectopia of the inguinoperitoneal type, with the testis and sac resting upon the aponeurosis of the external oblique There were 9 cases of the inguinoperineal type, the sac and testis occupied the perineal region

There has been no recurrence of the hernia in a single only two cases was the testis sacrificed In both the patients were adults and in one a small atrophied testis was found in the bottom of the sac of a very large inguinoperineal hernia The other case was one of abdominal ectopia, in which the testis could not be brought outside of the external ring

There has been but one recurrence of the hernia Seventy-two cases have been traced from 1 to 15 years with the following results 52 children were traced from 1 to 15 years, 17 less than one year, 15 not traced, of 44 adults, 19 were traced 1 to 10 years, 4 traced less than 1 year, 21 not traced

Results in Adults—Of 19 adults examined from 1 to 10 years after operation the testis was found in good position in

FIG 9



CASE XII Abdominal ectopia with filicore extending to the base of the uterus where it entered

the scrotum in 8 cases and at the external ring or not stated in the others

One case deserves special mention, inasmuch as it shows the probable influence of the operation upon epilepsy

The patient, aged 25 years, was operated upon 5 years ago, for right undescended testis of the inguinal type. The testis was brought into the scrotum and has remained in good position ever since. At the time of the operation he stated that he had been subject since childhood to epileptiform seizures, the attacks occurring frequently, often within 1 to 2 weeks. In a letter received January, 1908, he states that he has never had a single attack since the time of the operation. The patient was presented before the New York Surgical Society at the time the paper was read.

Results in Children—Testis in scrotum in 11 patients, testis outside of external ring in 15 patients and in canal or not felt in 4. The following cases illustrate the results in some of the patients traced for a considerable period of time.

CASE 1, aged 13 years at the time of operation. Examination 13 years later, shows the testis atrophied and resting just outside of the external ring.

CASE 2, aged 13 years at the time of operation. Letter 13 years later, states the testis is normal and in the scrotum. Patient is married and has one child.

CASE 3, aged 8 years at the time of operation. Examination 4 years later shows testis atrophied, just outside the external ring.

CASE 4, aged 5 years, inguinospermical type operation. Testis in scrotum 8 years after operation.

CASE 5, aged 6 years at the time of operation. Testis just outside the external ring, 7 years later, no atrophy.

CASE 6, aged 5 years at the time of operation. Testis just outside the external ring, 5 years later.

CASE 7, aged 9 years at the time of operation. Testis in scrotum, full size, 9 years later.

CASE 8, aged 12 years at the time of operation. Testis fully descended, examination 7 years later.

CASE 9, aged 10 years at the time of operation. Testis in normal position, no atrophy, examination 5 years later.

CASE 10, aged 13 years at the time of operation. Double, undescended testis, superficial inguinal kind. Operation 1905. Examination 2 years later shows both testes of normal size, in the upper part of the scrotum.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL
HERNIA TREATED BY OPERATION 1893 TO 1908 —(A) SECTION OF CHILDREN

No	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
1	V S	13	Right	Inguinal	Feb, '93	Testis brought into scrotum Anchored by cat-gut suture	Bassini	Primary union	Examination 13 years later shows atrophied testis just outside external ring Hernia cured
2	G R	8	Left	Inguinal	1, 18, '93	Testis brought into scrotum Anchored by cat-gut suture	Bassini	Primary union	Examination 4½ years later shows testis atrophied outside external ring Traced only 4 months
3	J O C	9	Left	Inguinal	6, 12, '94	Testis brought into scrotum Anchored by cat-gut suture	Bassini	Primary union	
4	M C	12	Right	Inguinal	1, 11, '95	Testis brought into scrotum Anchored by cat-gut suture	Bassini	Primary union	Examination 13 years later shows testis normal Patient married, has one child
5	M H	5	Left	Inguino-perineal	11, 15, '95	Testis transplanted to scrotum Cord normal length	Bassini	Primary union	Traced 8 years after operation Normal
6	G G	6	Right	Inguinal	3, 27, '96	Testis brought outside external ring Could not be made to reach scrotum	Bassini	Primary union	Examination 7 years later Testis outside external ring, not atrophied
7	T W	10	Left	Inguinal	3, 27, '96	Testis brought into upper scrotum	Bassini	Primary union	1 year later Well
8	D M	9	Right	Inguinal	7, 31, '96	Testis atrophied Placed in upper scrotum	Cord not transplanted (modified Bassini)	Primary union	Testis just outside external ring 5 years later
9	R B	9	Left	Inguinal	5, 21, '97	Testis brought into sac	Bassini	Primary union	Testis could not be felt 6 months later
10	H C	14	Left	Inguinal	7, 30, '97	Testis brought outside external ring	Bassini	Primary union	Well 7 years later
11	M G	7	Left	Inguinal	10, 29, '97	Testis brought into upper scrotum	Bassini	Primary union	Traced 1 year
12	J M	9	Left	Inguinal	6, 17, '98	Testis brought into scrotum	Bassini	Primary union	Traced 4 years
13	W T	9	Left	Inguino superficial	9, 2, '98	Testis brought into scrotum	Bassini	Primary union	Traced 1 year
14	O S	11	Left	Inguinal	10, 7, '98	Testis brought beyond external ring	Bassini	Primary union	Traced 2 years

15	J M	5	Right	Inguinal	10, 14, '93	Testis brought beyond external ring	Bassini	Primary union	Traced 7 years phied just outside external ring	Testis atrophied
16	H M	9	Right	Inguinal	11, 4, '98	Testis brought beyond external ring	Bassini	Primary union	Traced 8 years bottom of scrotum same size as other	Testis in
17	S P	7	Right	Inguinal	7, 21, '99	Testis brought beyond external ring	Bassini	Primary union	Traced 8 years phied outside external ring	Testis atrophied
18	W A	11	Left	Inguinal	8, 4, '99	Testis brought beyond external ring	Bassini	Primary union	Traced 4 years per scrotum normal size	Testis up
19	W W	11	Right	Inguinal	3, 30, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 6 years outside external ring	Testis just
20	A S	4	Right	Inguinal	5, 18, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 5 years	
21	I G	12	Right	Inguinal	7, 13, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 7 years, fully descended normal testis	
22	J H	10	Right	Inguinal	8, 3, '00	Testis brought into upper scrotum	Bassini	Primary union	Traced 2 years	
23	I H	9	Right	Inguinal	8, 10, '00	Testis brought into upper scrotum	Bassini	Primary union	Traced 8 years side external ring size of hickory nut	Testis outside
24	B C	7	Left	Inguinal	9, 11, '00	Testis brought into upper scrotum	Bassini	Primary union	Not traced	
25	H W	11	Left	Inguinal	6, 7, '01	Testis brought into upper scrotum	Bassini	Primary union	Traced 7½ years ternal ring	Testis external
26	J S	10	Right	Inguinal	1, 3, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced	
27	A W	12	Left	Inguinal	1898	Testis brought into upper scrotum	Bassini	Primary union	Traced 10 years canal	Testis in
28	J I	9	Left	Inguino superficial	2, 14, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced	
29	O H	10	Double	Double Inguino-superficial	3, 20, '02	Both testes brought into lower scrotum Cord normal length	Bassini	Primary union	Traced 5 years good position	Testis in
30	M V H		Right	Inguinal	6, 27, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced	
31	J B	8	Right	Inguino-superficial	9, 5, '02	Testis brought into upper scrotum	Bassini	Primary union	Traced 5½ years Well	
32	R K	10	Left	Inguinal	9, 5, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced	
33	A H	5	Right	Inguinal	1, 9, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced	
34	I K	5	Left	Inguinal	1, 23, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 8 months	
35	J I	9	Right	Inguinal	4, 10, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced	

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL
HERNIA TREATED BY OPERATION 1893 TO 1908—SECTION OF CHILDREN—*Continued*

No	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
37	J S	7	Left	Inguinal (interstitial sac)	4, 20, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 years felt
38	M L	8	Left	Inguinal	5, 1, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced
39-40	J C	11	D'ble	Inguinal	5, 1, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 months
41	R S	9	Right	Inguinal	5, 29, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 years
42-43	W T	12	D'ble	Inguinal	10, 30, '03	Testis brought into upper scrotum	Cord not transplanted on either side	Primary union	Traced 4 years
44	H W	11	Left		10, 30, '03	Testis brought into lower scrotum without tension	Cord not transplanted	Primary union	Traced 4 years
45	O H	12	Right	Inguino-superficial (traumatic) kick in groin	1, 22, '04	Testis placed in bottom of scrotum	Bassini	Primary union	Traced 9 months
46	J B	7	Left	Inguino-superficial	2, 5, '04	Testis placed in bottom of scrotum	Bassini	Primary union	Traced 4 years
47-48	T M	7	D'ble	Inguinal	2, 19, '04	Testes placed in scrotum	Bassini Left cord not transplanted	Primary union	Hernia cured, both testes just outside external ring April, 8, 1903, 4 years testes about one half normal size
49	H M	14	Left	Inguinal	4, 15, '04	Testis brought into upper scrotum	Bassini	Primary union	Not traced
50	L B	10	Right	Inguinal	3, 25, '04	Testis brought into upper scrotum	Bassini	Primary union	Traced 2 years
51	C S	6	Left	Inguinal	4, 22, '04	Testis brought into lower scrotum	Bassini	Primary union	Not traced
52	M M	8	Right	Inguinal (Putré) Testes join out side internal ring	9, 16, '04	Testis brought into upper scrotum	Cord not transplanted	Primary union	Traced 1 year
53	S I	13	Right	Inguinal	11, 4, '04	Testis brought into upper scrotum	Bassini	Primary union	Testis at external ring few months after operation
54	A S	12	Left	Inguinal	1, 13, '05	Testis placed in scrotum	Bassini	Primary union	Traced 3 years, good position
55	H A	8	Right	Inguino-superficial	2, 17, '05	Testis placed in scrotum	Cord not transplanted	Primary union	Not traced
56-57	H S	12	D'ble		5, 15, '04	Testes brought into scrotum	Cord not transplanted either side	Primary union	Traced 1 year, both testes still in upper scrotum, not atrophied

MALDESCENDED TESTIS

345

58	P A	4	Right	Inguinal	3, 17, '05	Testis brought into scrotum	Cord not planted	Primary union	Traced 2 years
59	J F	6	Right	Inguinal	4, 14, '05	Testis brought into scrotum	Cord not planted	Primary union	Traced 2 years
60	G L	' 8	Left	Inguinal	9, 22, '05	Testis brought into scrotum	Bassini	Primary union	Not traced
61-62	E S C	13	D'ble	Inguino-superficial	11, 23, '05	Both testes placed in bottom of scrotum	Bassini both sides	Primary union	Traced 2 years, both testicles outside external ring, no atrophy
63	H B	12	Right	Inguinal	1, 26, '06	Both testes placed in bottom of scrotum	Cord not planted	Suppuration	Traced 2 years Testis in bottom of scrotum
64	F W	6	Left	Inguinal	1, 20, '06	Both testes placed in bottom of scrotum	Cord not planted	Primary union	Died of scarlet fever while in hospital
65	E S	9	Right	Inguinal	2, 1, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 1½ years
66	W W	11	Left	Inguinal	2, 2, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 6 months
67	S S	7	Left	Inguinal	2, 16, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Not traced
68	A L	6	Right	Inguinal	3, 16, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 2 years Testis outside external ring, April 2, 1908
69	G M	11	Right	Inguino-superficial	3, 30, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 2 years Testis just outside external ring
70	W W	4	Right	Inguino-superficial	4, 27, '06	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 1 year Testis not felt
71	R L	11	Right	Inguino-superficial	3, 15, '07	Testes evenly placed in bottom of scrotum	Cord not planted	Primary union	Traced 1 year Testis at external ring
72	A B	13	Right	Inguino-superficial	3, 15, '07	Testis brought into mid-scrutum	Cord not planted	Primary union	Traced 1 year
73	E H	12	Right	Inguino superficial	3, 22, '07	Testis brought to bottom of scrotum	Cord not planted	Primary union	Not traced
74	H G	5	Right	Inguinal	4, 19, '07	Testis brought into scrotum	Cord not planted	Primary union	Traced 1 year
75	P Z	10	Right	Inguino-superficial	2, 15, '07	Testis brought into upper scrotum	Cord not planted	Primary union	Traced 1 year
76	F P	12	Left	Inguino-superficial, also femoral hernia	5, 3, '07	Testis brought into bottom scrotum	Cord not planted	Primary union	Traced 9 months
77	V B	7	Right	Inguino superficial	5, 24, '07	Sac rested on external oblique up to anterior superior spine Testis, ½ normal size, placed in scrotum	Cord not planted	Primary union	Not traced
78	F E	4	Right	Inguinal	5, 24, '07	Testis brought into bottom of scrotum	Cord not planted	Primary union	Traced 9 months Testis in upper scrotum

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL
HERNIA TREATED BY OPERATION 1893 TO 1908—SECTION OF CHILDREN—*Continued*

No	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
79	G M	5	Left	Inguinal	6, 10, '07	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Well 10 months
80	A B	7	Right	Inguinal	6, 10, '07	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Traced only 2 months
81	M M	6	Left	Inguinal	1, 3, '08	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Well at present, 3 months
82	J B	7 m	Left	Inguino perineal irreducible	1, 10, '08	Testis transplanted from perineum into bottom scrotum (Cong Hernia sic)	Cord not transplanted	Primary union	Well at present, 4 months
83	G N	6	Right	Inguinal	1, 24, '08	Testis placed in upper scrotum	Cord not transplanted	Primary union	Well at present
84	L R	5	Left	Inguino-superficial	2, 21, '08	Testis placed in scrotum	Cord not transplanted	Primary union	Well at present

TABLE OF CASES OF UNDESCENDED OR MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL
HERNIA TREATED BY OPERATION 1893 TO 1908—(B) ADULTS

No	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
85	M G	25	Right	Canal	1900	Testis brought into scrotum	C N T	Primary union	Well 1 year
86	J R	19	Right	Canal	1900	Testis brought into scrotum	C N T	Primary union	Well 1 year
87	Long	15	Right	Canal	1900	Testis brought into scrotum	C N T	Primary union	Not traced
88	W G	17	Right	Inguino perineal	1901	Testis transplanted into scrotum	C N T	Primary union	Well 6 years Testis in lower scrotum, no atrophy
89	J T	20	Left	Canal	1898	Testis brought into scrotum	C N T	Primary union	Well 4 years Testis external ring
90	L J	17	Left	Canal	1898	Testis brought into scrotum	C N T	Primary union	Well 6 years

91	L N	30	Left	Inguino-superficial, external ring, biocular sac	1898	Testis brought into scrotum	C N T	Primary union	Not traced
92	J M	27	Right	Inguino-perineal	1895	Testis atrophied moved	C N T	Primary union	Well 1 year
93	R	17	Left	Very long Inguinal	3, 15, '06	Testis brought into upper scrotum	C N T	Primary union	
94	C D	30	Right	Canal (epilepsy)	1903	Testis brought into scrotum	C N T	Primary union	Well 5 years
95	H W	30	Right	Inguino superficial	1902	Testis brought into scrotum	C N T	Primary union	Testis in scrotum, no further attack of epilepsy
96	W K	23	Left	Abdominal retention	1903	Testis brought to upper scrotum	C N T	Primary union	1 year later testis outside external ring
97	C S	28	Right		1902	Testis brought into scrotum	C N T	Primary union	Not traced
98	G D	17	Double	Canal, both sides	1902	Testis brought into scrotum	C N T	Primary union	Well 1 year
99	T E	40	Right	Inguino-perineal	1902	Testis transplanted into scrotum	C N T	Primary union	1 year later both testes in scrotum
100	S S	20	Left	Inguino-superficial	1902	Testis brought into scrotum	C N T	Primary union	Testis in scrotum 5 years later
101	T S	18	Right	Inguino-superficial		Testis brought into scrotum	C N T	Primary union	
102	J I	33		Inguino superficial	1903	Testis brought into scrotum	C N T	Primary union	
103	C D	29	Right	Inguino-perineal	1907	Testis transplanted into scrotum	C N T	Primary union	Testis soon got back into perineum, second operation October, 1907, situated in scrotum Perfect result April, 1908
104									Not traced
105	W C	16	Right	Inguino-perineal	1896	Testis transplanted into scrotum	C N T	Primary union	Hernia recurred 1 year later
106	A S	35	Right	Inguino-perineal	1896	Testis transplanted into scrotum	C N T	Primary union	Not traced
107	H L	20	Left	Inguino-superficial	1905	Testis brought into scrotum	C N T	Primary union	
108	T G	45	Left	Abdominal	5, 23, '06	Testis atrophied, removed into canal	C N T	Primary union	
109	E M	25	Right	Inguino-superficial	1, 22, '06	Testis atrophied, removed into canal	C N T	Primary union	Well 2 years later
110	D R	38	Right	Canal	July, '06	Testis brought into scrotum	C N T	Primary union	Not traced
111	G C	22	Right	Inguino superficial	11, 14, '06	Testis brought into scrotum	C N T	Primary union	Not traced

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL
HERNIA TREATED BY OPERATION 1893 TO 1908—ADULTS—*Continued*

No	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
112	S G	22	Left	External ring	4, 10, '07	Testis brought into scrotum	C N T	Primary union	Not traced
113	M E	16	Left	Inguino-superficial Bilocular sac	Apr, '07	Testis transplanted into scrotum	C N T	Primary union	Not traced
114	O R	30	Right	Canal	Feb, '06	Testis transplanted into scrotum	C N T	Primary union	Not traced
115	H W	20	Right	Inguinal	Feb, '06	Testis transplanted into scrotum	C N T	Primary union	Not traced
116	G T	14	Left	Inguinal	Aug, '04	Testis transplanted into scrotum	C N T	Primary union	Well 3½ years Testis increasing in size Hernia cured
117	B A	23	D'ble	Left inguinal Right abdominal	10, 20, '04	Left operation (Dr Downs) Right testis in abdomen not operated on	C N T	Primary union	Not traced
118-119	E R	16	D'ble	Inguinal	Nov '04	Testis brought into scrotum (Op Dr Downs)	C N T	Primary union	Right testis in scrotum two years later, left external ring
120	S M	21	Left	Inguinal	Feb, '05	Testis brought into scrotum	C N T	Primary union	Testis in middle scrotum March 27, 1908 nearly 3 years
121	A B	41	Right	Superficial inguinal	5, 4, '05	Testis brought into scrotum	C N T	Primary union	March 28, 1908, letter states slight relapse, no hernia
122	L F	38	Left	Superficial inguinal	Oct, '05	Testis brought into scrotum	C N T	Primary union	Testis in bottom of scrotum, no atrophy 2½ years later
123	F C	22	Right	Superficial inguinal	11, 22, '05	Testis brought into scrotum	C N T	Primary union	No atrophy of testis
124	J C	16	Right	Canal	12, 6, '05	Testis brought into scrotum	C N T	Primary union	Well at present upper scrotum
125	S	20	Right	Inguino superficial	7, 19, '07	Testis brought into scrotum	C N T	Primary union	Testis in scrotum
126	A H	24	Right	Inguino superficial and interstitial bilocular sac	3, 19, '08	Testis brought into scrotum	C N T	Primary union	Testis in scrotum
127	H W	17	D'ble	Abdominal	4, 16, '08	Right testis brought into upper scrotum No operation on left side	C N T	Primary union	Testis in scrotum
128	J B	22	Right	Abdominal	4, 16, '08	Right testis brought into upper scrotum	C N T	Primary union	Testis in scrotum

CONCLUSIONS

From my own observations as well as from a careful study of the reports of other surgeons, I believe the following conclusions are justified.

1 The undescended testis is almost invariably of little or no functional value. It often gives rise to considerable pain and is more subject to inflammatory attacks than the normally descended organ and, possibly (though this is by no means proven), is more subject to malignant changes.

2 The undescended testis should never be sacrificed in children and very rarely in adults, it having been proven possible to effect a radical cure of the hernia quite as well without the removal of the organ. In childhood the testis, even if it never attains any functional value, is nevertheless of value in developing the male characteristics of the child as well as in promoting his general health. In the adult, it should be retained for its influence upon the mentality of the subject, if for no other reason.

3 Operation should seldom be performed under the age of 8 to 12 years, unless the accompanying hernia demands such operative intervention, for the reason that in a considerable number of cases the testis descends spontaneously on the approach of puberty, unless double.

Abdominal ectopia unless double had best be left untreated, inasmuch as operation is difficult and by no means free from risk.

4 As to methods of operation, the main principles of any operation likely to yield satisfactory results, must be: Free opening of the inguinal canal, which is secured by Bassini's incision, thorough freeing of the testis from any adhesions or peritoneal bands, even with the sacrifice of some of the veins, if necessary, bringing the testicle into the scrotum, suture of the canal without transplantation of the cord.

The present tendency in favor of giving up all forms of suturing the testis, either to the scrotum, the other testis or the thigh is, I believe, fully justified.

Inasmuch as very satisfactory results may be obtained without cutting away all the structures of the cord except the

vas and its vessels, I believe this more radical step very seldom indicated

5 No case of double undescended testis should be allowed to reach the age of puberty

BIBLIOGRAPHY

- ¹ Klein L'Ectopie Perineale, These de Paris, 1905-6
- ² Lockwood Development and Transition of Testis, normal and abnormal, Hunterian Lectures, 1887, Brit Med Jour, 1887, 1, 444-610
- ³ Godard Compte Rendus des Seances et Memoires de la soc de Biologie, 1856, III, p 315-459
- ⁴ Hunter London, 1786
- ⁵ Marshall 1894 Perineal Testis Restored to Its Proper Position
- ⁶ Lanz Ektopie Testis, Centralbl f Chir, 1905
- ⁷ Sharp Testis in Perineum in Infancy, Brit Med Jour, 1903, 1, 16
- ⁸ Pollard Case of Perineal Displacement of Testis, Lancet, July 16, 1904, p 70
- ⁹ Martin Perineal Testis Restored to Proper Position Annals of Surg, 1894, 11, p 95
- ¹⁰ Felizet and Bronca Histologie du Testis Ectopic, Journal d'Anatomie et Physiologie, 1898, xxxi,-xxxii, pp 941-967
- ¹¹ Ibid Journal d'Anatomie et Physiologie, 1902, p 328
- ¹² Curling Traite pratique des Maladies du Testicule, 1857-1878
- ¹³ Braman Beitrage z Lehre von dem Descensus Testiculorum und dem Gubernaculum Hunteri, Arch f Anat and Entwicklungs, Geschichte v His and Braune, 1884
- ¹⁴ Ibid Der Processus vaginalis und sein Verhalten bei Storungen des Descensus, Arch f Klin Chir, 1890, Bd 40, H 1
- ¹⁵ Championnière (Les Anomalies du Testis) Leçon de Clinique Chirurgicale faite a l'Hotel Dieu
- ¹⁶ Le Conte Sarcoma of the Undescended Testis, Strangulated by Torsion of Cord International Clinics, vol iv, 1907
- ¹⁷ Odiorne and Simmons The Undescended Testis Annals of Surg, 1904
- ¹⁸ Monod et Terrillon Maladies du Testicule, 1889
- ¹⁹ Sebileau Les Envelopes du testicule Paris, 1897
- ²⁰ Tuffier Traitment Chirurg de l'Ectopie Testiculaire Gaz des Hop, 1890, p 349
- ²¹ Broca Traitment de l'ectopie Testiculaire, Gaz Hop, 1899, p 315
- ²² Budinger Etiology of the Undescended Testis Zeitschr f Chir, Oct, 1907
- ²³ McAdam Eccles "The Imperfectly Descended Testis 1903

OPERATION FOR UNDESCENDED TESTICLE *

BY F. N. G. STARR, M.B.,

OF TORONTO, CANADA,

Associate Professor of Clinical Surgery in the University of Toronto

Associate Surgeon to the Hospital for Sick Children

Assistant Surgeon, Toronto General Hospital

FROM a brief scrutiny of the literature it would seem that there is thought to be a small chance of help for non-descended testicle except by castration. Erichsen ¹ says, "Any attempt to bring the testicle down into the scrotum would be ineffectual." He further adds, that if it is in some position in the canal where injury is likely to occur, it is preferable to remove it. Treves ² says the undescended testis should be stitched to the bottom of the scrotum, and under certain circumstances should be removed. Pick ³ thinks one should consider the feasibility of transplanting the gland and fixing it in the scrotum. If this cannot be done he recommends its removal. Bryant, ⁴ after describing a fascinating method, adds, "The successful attainment of these steps is not easy, nor finally as satisfactory as might appear from the description." Stonham ⁵ describes an operation where he makes a long incision and transplants the testicle, suturing the tunica albuginea to the scrotum. Kocher ⁶ recommends fastening the spermatic cord at its entrance into the scrotum, as well as fastening the testis to the bottom of the scrotum. Corner ⁷ says that replacement in the abdomen is indicated in by far the majority of cases. Bevan ⁸ describes an elaborate operation which necessitates opening the peritoneal cavity. Von Braumann ⁹ advises strongly against removal.

From the foregoing remarks it will readily be seen that there seems little to choose from in the various methods recommended. Some other writers advise massage and manipula-

* Read at the Surgical Section of the Academy of Medicine of Toronto

tion, and no doubt if begun early, and carried out persistently, some of the cases might be cured. Others have recommended a U-shaped truss to fit just above the testicle and force it down while yet others have described various mechanical devices with the same object. Such methods have only to be mentioned to be condemned.

It would seem then that surgeons are divided between,—suturing to the bottom of the scrotum, transplanting within the abdomen, and removal. This latter cannot be too strongly condemned, for no matter how atrophic a testis may appear, one has no means of knowing the possibilities of development under suitable conditions.

When it comes to the question of operation, no doubt there are some cases in which, with the testis at or near the internal abdominal ring, it may be wise to transplant the gland within the abdomen, to remove it from the possibility of injury. But, when the testis is in the inguinal canal, near the external ring, or is outside the ring, the following operation which I have devised and carried out successfully, appeals to me as a reasonable means of securing a desirable result.

An incision about one inch long is made over the external abdominal ring, the testicle is secured and brought out of the wound. The finger is then carried down into the scrotum, and, by means of blunt dissection, the scrotal sac is stretched to make a suitable resting-place for the testis. The cord is then dissected free of its coverings, and if necessary to secure increased length, the cremasteric and spermatic arteries may be sacrificed, but the artery to the vas must not be interfered with. It is well now to see that the testicle can be easily replaced in the pocket provided without tension upon the cord. It is again taken out and sutured by means of chromic catgut. No. 0, through the tunica albuginea to the loops of a piece of plaited silver wire, two or three inches long, as may be required (Fig 1 (a)). The wire ends at (b) are then pushed against the bottom of the scrotum and cut upon to permit of their being pushed through. The free ends are then bent, as in Fig 2 (b). To make assurance doubly sure two horsehair sutures are

FIGS 1 AND 2



Showing testis secured to loop of silver wire to act as splint for returning it in scrotum

passed up through the tiny opening in the scrotum, from which the wire projects, one on each side of the wire shaft, to catch the tunica albuginea. They are brought out again and tied over the projecting wire ends (Fig 3 (b)). The loop of the wire shaft at (c) is now sutured by means of 10-day chromic catgut No. 1 to the periosteum over the os pubis (Fig 3 (c)). The testicle is now securely placed in the scrotum and is maintained there by means of a silver wire splint. The operation

FIG 3

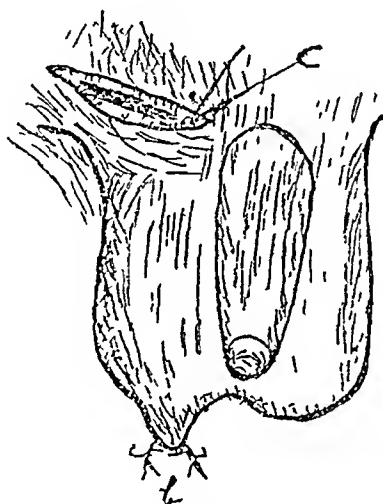


Diagram to show splint in position (C) Catgut that secures loop of splint to periosteum over the os pubis

is completed by introducing through the skin, at one end of the incision, a horsehair suture which travels sub-cutaneously, taking up the spermatic fascia and divided cremasteric muscle over the cord. It is brought out again through the skin, at the opposite end, carried over the top of a small roll of gauze, and continued along as an uninterrupted stitch, to bring the skin edges into apposition. The two free ends are tied over another small roll of gauze. The wound is carefully dressed with plenty of pads and a double spica applied. On the twelfth day the dressing is removed, and the cutaneous horsehair, snipped at one end, is then easily withdrawn. The two horsehair stitches at (b) are now cut and removed, when the end of the wire is grasped with a pair of forceps and the wire splint removed.

The result has been most satisfactory Both testicles are on a level, both are now of equal size, though the non-descended one was small at the time of operation There was no pain or discomfort during healing, and I was surprised at the ease with which the wire splint came away

This operation holds out some hope for the correction of an abnormality that heretofore has not been amenable to treatment, other than such as will lead to a greater deformity, even though it does succeed in relieving pain and discomfort

REFERENCES

- ¹ Science and Art of Surgery, Erichsen, 1888
- ² A System of Surgery, Treves, 1896
- ³ Surgery, T Pickering Pick, 1899
- ⁴ Operative Surgery, J D Bryant, 1901
- ⁵ Manual of Surgery, Stonham, 1900
- ⁶ Tillmann's Textbook of Surgery, 1898
- ⁷ British Medical Journal, June 4, 1904
- ⁸ Journal of American Medical Association, Sept 19, 1903
- ⁹ Von Bergmann's System of Practical Surgery, 1904

THE RADICAL TREATMENT OF CARCINOMA OF THE BLADDER

BY ALBERT ASHTON BERG, M D ,

OF NEW YORK,

Adjunct Surgeon to Mount Sinai Hospital

THE percentage of ultimate cures effected by the various radical operations for carcinoma of the urinary bladder is very small and does not bear favorable comparison with that which is achieved in the radical treatment of carcinoma of other organs. These bad results are partly owing to the complicated problems we are called upon to meet in dealing with malignant neoplasms of this viscus, and partly to the fact that we have neglected to fully appreciate certain facts in the pathology of this disease.

The radical operative cure of a malignant tumor, according to our present conception, demands a wide removal of the primarily diseased tissue and of the secondarily affected lymphatics and glands. When malignant deposits have extended beyond the immediate local glandular apparatus or have appeared in distant organs, the idea of a radical extirpation of the disease can no longer be entertained. It is surprising how these axiomatic principles for the radical cure of malignant tumors are constantly ignored in cases of malignant growths of the urinary bladder. Thus it has been, and still is, the common practice to entirely ignore the lymphatics and glands in the radical operation for cancer of this viscus, owing possibly to the idea that these structures are usually not affected. This supposition, however, is entirely erroneous. In the very early stages of the malignant growth, when the neoplasm is confined to the mucosa and is not ulcerated, the lymphatics and glands usually show no malignant changes, but as soon as the tumor invades and infiltrates the muscular coats of the bladder the spread to the lymphatics and glands

takes place, and no operation can be a radical one that does not include a wide removal of these latter structures. In 56 cases of infiltrating cancer of the bladder collected by Guyon, glandular enlargement was positively recorded in 15, and in the other 41 no mention was made as to whether the glands were or were not involved.

In a previous communication the writer called attention to the necessity of a wide removal of all infected sacral and iliac glands and described the technic for their extirpation (ANNALS OF SURGERY, 1904, vol 40, 382)

Another consideration of vast importance has only recently been called to our attention by Dr F Mandlebaum in his admirable study of "New Growths of the Bladder," published in Surgery and Gynæcology, V, 315, 1907. In 1870, Klebs (Handb d Path Anat) announced his view that carcinomata of the bladder are always secondary to primary deposits in the prostate, rectum, or uterus, and that in women at least a primary tumor of the bladder cannot be cancerous. This opinion was combatted by the school of Necker and defended again by Motz and Monfort. The importance of this point is very evident. If Klebs is right, then in the male subject the removal of the prostate is essential to every radical operation for bladder cancer. Mandlebaum carefully studied this particular question. He found that the papillary and the flat or squamous-celled carcinomata do occur as primary tumors in the bladder, but that the fibro- or scirrhous-carcinomata, and the adenocarcinomata are very often, if not always, secondary to primary tumors of the prostate, uterus, or rectum. Thus he had in his collection of cases five of fibro- or scirrhous-carcinomata. In these patients a clinical diagnosis of primary malignant tumor of the bladder was made, because a careful physical examination of the prostate and rectum had failed to reveal any evidence of malignant trouble in these organs. Yet a close study of the extirpated tumors and a postmortem examination in two of the patients revealed the fact that in four of the cases the neoplasm was primary in the prostate and secondary in the bladder. He

made a similar observation in two cases of apparent primary adenocarcinoma. In these two patients a postmortem examination showed that the prostate was the primary focus of disease, though no evidence thereof was furnished by a careful physical examination during life.

If the conclusions reached by Dr. Mandlebaum are confirmed by further investigation, their bearing upon the surgical aspects of vesical carcinomata will be very great. They teach us first of all not to rely upon the evidence furnished by physical examination in forming our opinion as to the existence of a malignant tumor in the prostate. Secondly, they demonstrate the great importance of knowing the exact histological character of every malignant tumor of the bladder before proceeding to its radical removal, for of what use is it to extirpate a part or the whole of the bladder if thereby is removed only a secondary deposit, while the primary growth in the prostate, uterus, or rectum is left unmolested? If the adeno- and scirrhus-carcinomata are found to be always secondary tumors, then the radical operation for their cure must include a wide removal of the primarily diseased part. In the light of Dr. Mandlebaum's investigations, the writer does not doubt that many recurrences after radical operations for vesical cancer are due to the fact that an unrecognized primary focus of malignant disease in the prostate, uterus, or rectum was left behind at the time of the operation, and he is convinced that attention to the facts brought out by Dr. Mandlebaum will better our percentages of ultimate cures of this malady.

With these preliminary remarks on the pathology of vesical carcinomata and the bearing they have upon the extent of operative procedures undertaken for their radical cure, we come to consider how best to deal with the neoplasm, and here the operator must give his attention not only how to widely remove the tumor, but also how to restore or substitute for the function of a urinary reservoir which the bladder serves.

This latter fact complicates the problem very much and has been and still is the subject of much discussion. If the

reservoir function of the bladder could be entirely dispensed with or satisfactorily and safely replaced or substituted for in some manner, a vesical carcinoma could be dealt with much as is a carcinoma of the gall-bladder, namely, by complete excision of the affected organ, but thus far all our experience has not succeeded in demonstrating how to so safely replace or substitute for this urinary function of the bladder. The use of the rectum, vagina, or partly excluded loop of intestine, *e g*, the sigmoid flexure or small intestine, as a substitute for the bladder, has been mostly abandoned because of the danger entailed thereby of an infection from these viscera ascending the ureters to the kidneys, with consequent pyelonephritis and death. Similarly, the doing away altogether with a urinary reservoir by implanting the ureters onto the skin of the abdomen or loin, or by direct drainage of the kidney-pelvis through the loin (double nephrostomy) exposes the kidneys to the same dangers of infection, and places additional worry, annoyance, and discomfort upon the patient in the attention and care that must be expended upon the toilet of the urinary fistulæ.

Our ineffectual efforts to provide a satisfactory substitute for the reservoir function of the bladder or to safely and conveniently do away with it altogether make it very desirable in the radical operations for vesical cancer to preserve enough of the bladder to act as a urinary reservoir, provided this is consistent with the requirements of a radical extirpation of the disease. This desideratum at once brings up the following questions:

- 1 Is it possible to effect a lasting and permanent cure of a vesical carcinoma by a partial resection of its wall, or is it necessary in every case to completely excise the viscus?

- 2 In case partial resection is consistent with the requirements of a radical extirpation, how much bladder wall must be left in order to make a satisfactory urinary reservoir?

As regards the first of these questions,—*viz*, is it possible to effect a lasting cure of a carcinoma of the bladder by a partial resection of its wall, or is it necessary in every case

to completely excise the viscus?—Rafin, in his masterly monograph on Tumors of the Bladder, published in *Compte rendu de l'association française d'urologie* for 1905, gives the results of 96 partial cystectomies for carcinoma. These cases were collected from literature and by personal communication with those in charge of large hospital services. Of these 96 cases, 21 died from the operation, and 25 could not be subsequently traced. Of the remaining 50,

1 was well after 3 years

1 was well after 3 years and 4 months

1 was well after 4 years

1 was well after 5 years

1 was well after 6 years

16 were well at periods ranging from 6 months to 2 years

Twenty-one of the fifty then were living without recurrence at periods varying from six months to six years, and five had passed the three-year limit. In view of these reports there cannot be any doubt of the possibility of radical cure by partial resection of the bladder.

It is true that the immediate mortality of the operation in the cases reported by Rafin is very high—21+ per cent—and that the number of permanent cures is very small, but the fact is clearly demonstrated that by partial cystectomy a radical cure can be effected, and it is only reasonable to assume that with improved technique the operative mortality will be less, and that with earlier recognition of the disease and attention to the pathological facts already mentioned, the number of permanent cures will be much increased.

Watson, however, from an extended study of the cases reported in literature, takes a different view from that just expressed. He holds that the chief causes for the high mortality attending operations for vesical carcinoma and for their frequent recurrence seem to be in the failure to operate soon enough and radically enough. To quote his emphasized statement: "The very large percentage of recurrence seems to point logically to the necessity of more radical measures in

benign as well as in cases of malignant tumors, if we are to hope for better results. The suggestion I have to make in this report is that total extirpation of the bladder and of the prostate, if it be involved in the pathological process, be done at the outset in all cases of carcinoma that have not extended beyond the above named structures and in which it is believed that there are no metastases, and that the same measure be applied in all cases of benign growths in which recurrence has taken place after a primary operation for their removal."

He goes on to say that ureteral implantation which contributes, as it seems, to the surgical failures, should be abandoned, and *lumbar nephrostomy*, with ligation of the ureters done instead, and at some time previous to the operation for the removal of the tumor, as it seems to offer a much safer and less objectionable way of disposing of the most difficult part of the latter operation.

It is important that we consider in detail these statements of Dr. Watson, which have for their foundation not his own acute clinical observation and personal experience, but merely the records of cases reported in the literature.

In this consideration it is necessary first of all to compare the immediate and late results after partial and complete cystectomy. Rafin collected 30 cases of total excision of the bladder for carcinoma. In 17 of these there was a fatal issue to the operation, *i e*, a mortality of 56.5 per cent. Five of the surviving cases could not be traced, in 3 death occurred from kidney complications, 4 months, 13 months, and 5½ years respectively, after operation, and 3 were well 7 months, 15 months, and 5 years respectively, after operation. These results compare most unfavorably with those obtained after partial cystectomy, for in the latter the immediate mortality was much lower—21 out of 96 cases, *i e*, 21.7 per cent, and the ultimate results were better, inasmuch as 21 out of 50 cases were known to be well and free from recurrence at periods varying from six months to six years after operation.

Of the 17 immediate operative deaths after complete

cystectomy in the series collected by Rafin, 9 were from renal causes, and it is possible that some of these might have been averted by a preliminary lumbar nephrostomy, as suggested by Watson. The latter author is in favor of complete extirpation for two reasons (1) the dangers of recurrence after partial cystectomy, and (2) the dangers of ascending infection to the kidneys resulting from ureteral implantation into the bowel or vagina or on to the skin of the loin or abdomen. In answer to these objections to partial cystectomies it is to be noted that the percentage of recurrence after total extirpation of the bladder is almost as high as in those who survive the partial extirpation. Of Watson's 25 collected cases of complete extirpation, 11 survived, and of these only 2 were alive and free from recurrence after three years, 1, three years, and 1, eight years, respectively, whereas, of Rafin's 96 cases of partial cystectomy, the 50 that survived and could be traced, included 5 that had safely passed the three-year limit without recurrence.

As regards this question of recurrence, it is the writer's opinion that the dangers thereof are not materially dependent upon whether a complete or partial cystectomy be done, provided, of course, that the disease is widely extirpated, but that they are dependent, as stated in a preceding portion of this paper, first, upon whether all the cancer-infected glands and lymphatics are simultaneously removed with the primary tumor, and, secondly, upon whether, when the primary neoplasm is in the prostate, uterus, or rectum, these affected parts are likewise removed, together with the vesical tumor.

In other words, the writer thinks that where the carcinoma is primary in the bladder and limited to one part thereof, a wide removal of the neoplasm (partial cystectomy), together with all the lymphatics and glands will afford as sure a protection from recurrence as will a complete extirpation of the organ.

In reference to the proposal that a preliminary bilateral lumbar nephrostomy with ligation of the ureters should replace ureteral implantation into the intestine or vagina or onto

the skin of the abdomen or loin, Watson urges that the time of operation would be thereby shortened, that liability to kidney infection would be much less, and that the procedure supplies immediate and sufficient drainage from the kidney and is the best means for giving prompt relief to renal retention

These arguments can apply *prima facie* only to complete extirpation with ureteral implantation into the intestine, or vagina or onto the skin, as against complete extirpation with preliminary lumbar nephrostomy, and not as against partial cystectomy with ureteral reimplantation into the bladder, for in the first place the danger of ascending kidney infection through a ureter that has been reimplanted into a remaining normal part of the bladder is not greater than that after a lumbar nephrostomy. In fact, it would seem, judging from the writer's experience with this latter procedure done for other causes—*i.e.*, persistent hæmaturia, stone, etc., that some infection of the kidney pelvis always results therefrom

Watson furthermore estimates the mortality resulting from ureteral implantation into the intestine, vagina, or skin, as being much higher than that resulting from direct lumbar nephrostomy. Of this there is no question. But we must not confuse the dangers of ureteral implantation into an infected viscus with the dangers resulting from ureteral reimplantation into the bladder, as is the case when a partial cystectomy is done. According to Watson's own figures, the operation of nephrostomy done for any and all causes is 15 per cent. Surely if we are to accept this figure as pertinent to nephrostomy done as a preliminary procedure to a radical operation for bladder carcinoma, we must acknowledge that for a preliminary step the mortality is inordinately high, and we could scarcely be expected to enter heartily into any proposal that promises so large a percentage of deaths before we even commence a radical cure of the disease itself. As a matter of fact, however, the writer does not believe that a preliminary nephrostomy—when the kidneys are comparatively healthy—

has anything like so high a mortality as 15 per cent, and surely ureteral reimplantation into a healthy part of the bladder, done according to the modern improved technic, as will be later described, is not attended with anything like 15 per cent of immediate operative deaths

As to the comparative dangers of infection of the kidney after bilateral nephrostomy and ureteral reimplantation into a healthy bladder, there are no reliable figures or extended clinical experiences upon which we can at present base conclusions. There are instances of late infection of the kidney pelvis after lumbar nephrostomy as well as after ureteral reimplantation into the bladder, and only continued trial of the two procedures will demonstrate in which of them the dangers of late kidney infection is the greater

Watson further dwells on the advantages of lumbar nephrostomy in case the kidneys are already infected. In such cases the good effect of drainage of the kidney pelvis cannot be questioned, but surely one cannot contemplate a radical operation for the bladder cancer under such conditions. In patients with this complication, radical operations have no place—only palliative procedures are to be considered in them.

Furthermore, there are serious objections to a general use of lumbar nephrostomy in operation for bladder tumors. The proper care of such urinary fistulæ is possible only by the highly intelligent and cleanly who can be taught the principles of asepsis, and by those who do not have to engage in hard manual toil. In all others the dangers of kidney infection are much greater, and the wearing of an apparatus such as is described by Watson is hardly consistent with the occupation of mechanics or laborers.

Taking into consideration then all the facts first, that the freedom of recurrence after partial cystectomy is as great as that secured by complete extirpation, secondly, that the immediate operative mortality after partial cystectomy is not half as high as that after entire removal of the bladder, thirdly, that the objections raised by Watson to ureteral implantation into the intestine, vagina or skin do not maintain

to ureteral reimplantation into a remaining healthy portion of the bladder, the writer is forced to the conclusion that when we have to deal with growths limited to a third of the bladder, and especially when their site is on the fundus and lateral walls, *partial cystectomy with reimplantation of the ureter into the remaining portion of the bladder when the ureteral orifice is involved in the disease is by far the operation of choice*

It must not be inferred, however, that total extirpation has no place in our consideration of the radical cure of this disease, for when the cancer is diffusely spread over the greater part of the bladder, thus forbidding us to save a sufficient portion thereof to form a reservoir for the urine, or when there is a bad cystitis that does not yield immediately to therapeutic measures and which necessarily increases materially the dangers of ascending ureteral infection after reimplantation of the ureters, then complete extirpation is advisable provided the patient is otherwise sound

The preliminary operation of lumbar nephrostomy would certainly seem to be indicated when complete excision is done

In reference to the second question that I have proposed in connection with partial cystectomy, viz, how much bladder wall must be left to form a satisfactory reservoir for the urine?—there are no reports in the literature bearing upon this point. The writer in one case removed slightly more than one-half of the bladder, and the remaining portion performed the function of a reservoir very well. The patient could hold his urine easily for three hours, he had to get up twice at night to urinate, and was very comfortable. In his three other cases about one-third of the bladder wall was removed. In two of these latter that survived the operation the remaining portion of the bladder functionated excellently as a reservoir, the patients being able to hold their urine almost as well as in their healthy state. In the light of these experiences the writer would say that one should be able to remove fully one-half of the bladder without materially interfering with the function of this organ, and that the removal of a third

of the viscus does not have any appreciable effect upon the function of the remaining portion

A few words in reference to the technic of partial cystectomy as done by the writer and described by him in *ANNALS OF SURGERY*, 1904, vol 40 A median incision is made above the symphysis or a lateral one at the outer margin of either rectus muscle, depending upon the location of the tumor in the bladder as previously determined by the cystoscope This incision is deepened down to the peritoneum, which latter is then stripped back from the pelvis and from the bladder If the tumor occupies the peritoneal surface of the bladder the affected part of this membrane will likewise have to be removed The peritoneal cavity is therefore best opened in such cases at once and the intestines protected with warm pads With the patient in Trendelenburg's position search is made for glandular enlargement along the course of the internal iliac artery and in the concavity of the sacrum When such glands are present, they are carefully removed, together with the surrounding fat Such glandular enlargement must be sought for up to the bifurcation of the common iliac artery and along the promontory of the sacrum During this procedure there is sometimes considerable oozing from the rich venous plexuses in the pelvic cellular tissues, but this can always be controlled by pressure with gauze or sponges The ureter corresponding to the affected side of the bladder is now located and dissected out down to its entrance into this viscus, and the pelvic space is carefully lined with iodoform gauze so as to prevent its infection during subsequent manipulations The bladder is opened in healthy tissues to one side of or above the tumor, and the surface of the neoplasm at once cauterized with the actual cautery or pure carbolic acid I deem it the better plan to remove the neoplasm after the bladder has been opened, working from the interior outward, rather than to excise the tumor mass from without inward, for with the limits of the neoplasm directly visible it is possible to make a wider resection into healthy tissue If the neoplasm is found to involve the lower end of the ureter, this is divided

in healthy tissue and the proximal end temporarily closed with a seraphim to prevent leakage of urine over the field of operation. The stump of the ureter is then reimplanted into the *vertex* of the *bladder*.

This reimplantation into the vertex, as against reimplantation into the base of the bladder at the site previously occupied by the neoplasm, is important for the following reasons. In the first place, if the ureter is implanted into the bladder at the site from whence the neoplasm has been removed, it will be very difficult to effect an impervious junction, and furthermore, inasmuch as at this site there is likely to be some marginal necrosis, the liability of ascending infection from such necrosis along the ureter to the kidney is very much increased. The defect in the bladder caused by the removal of the neoplasm is now closed with two layers of sutures, one a catgut Connell suture passing through all the walls of the viscus, and the other an external mattress suture of fine silk going through only the muscular coats. I have found it sufficient to drain the bladder through the urethra, but if deemed necessary a suprapubic opening for drainage may be established. It is very essential to provide liberal gauze drainage of the cellular tissues in the pelvis, always, however, taking the precaution to place a strip of rubber tissue between the suture line in the bladder and the gauze. The bladder drainage is removed after six days and the patient is permitted to pass his urine spontaneously. Frequent washings of the bladder at this time will relieve the cystitis resulting from the operative manipulations.

Thus far the writer has had occasion to practice this operation four times. In two of the cases the growth in the bladder was secondary to extensive uterine carcinomata, one of the patients being a young woman with extensive vaginal, uterine and broad ligament carcinoma, in whom radical operation was undertaken only because of the extreme youth of the patient and at the earnest solicitation of her friends and relatives. In one of these patients there was a recurrence of the malady in the pelvis a year and a half after operation, and in

the other evidences of returning carcinoma appeared after six months. Neither case was a favorable one for radical cure. As regards the bladder complication, although one-third of this organ had been removed and the ureter reimplanted into the bladder, the patient was able to hold the urine almost as well as in her normal state.

In a third patient the bladder cancer appeared to be favorable for operation. There was noted in the prostate before operation a nodule about the size of a small hazelnut which was not, however, thought to be malignant. The neoplasm in the bladder about the size of a silver half dollar and of a squamous-celled type, together with the terminal half inch of the left ureter was removed, according to the method described above, and the ureter was reimplanted into the vertex of the bladder. An uninterrupted convalescence took place. The wounds were completely closed at the end of four weeks, the patient had perfectly normal bladder function, and remained well for fourteen months after the operation. He then showed evidences of prostatic enlargement, and on examination it was found that the previously described nodule in the organ had increased very considerably in size and was hard and fixed. The removal of this nodule was deemed inadvisable and the patient succumbed to a prostatic cancer somewhat more than a year later, a little over two years after the operation. In this case the bladder tumor was probably secondary to the prostate cancer, and the prostate should have been removed together with the bladder tumor.

The fourth patient was a favorable one for radical operation. He had a tumor about the size of a silver half dollar occupying the right side of the bladder and the right ureteral orifice, was in good physical condition, and about 58 years of age. The lymphatic glands and bladder tumor were removed in the usual manner, but I deviated from my usual practice of reimplanting the ureter into the vertex of the bladder and followed the suggestion made by a colleague of making the ureteral implantation into the base of the bladder at the site occupied by the neoplasm. All went well until the sixth

day, when there were evidences of septic infection, a pneumonia developed at the base of the lung, and the patient succumbed three days later. At the autopsy it was found that there had been a leakage of a few drops of urine at the site of the ureteral junction and that there had been an ascending infection of the pelvis of the right kidney, which contained a few drops of pus. Whether this last mentioned condition or the pneumonia was the cause of death it is, of course, difficult to say, but the fallacy of reimplanting the ureter into the base of the bladder was well demonstrated, and in subsequent cases I should certainly not select this site for reimplantation. Unfortunately the writer was not aware that Albarran and Rafin have had the same experience with reimplantation of the ureter at the base of the bladder. They likewise have come to the conclusion that in partial cystectomy involving the ureteral orifice it is far more advisable to reimplant the ureter into the vertex than into the base of the bladder.

Simple removal of a cancerous tumor from the bladder, either by the curette or knife or actual cautery through a suprapubic opening without partial or complete cystectomy, has not been considered in this paper amongst the radical operations for this disease, although there are cases in the literature of a permanent cure having been accomplished in this way. Such instances are very rare and a lasting cure by an operation of this kind is possible only when the tumor is a pedunculated one and its base not infiltrated with malignant disease.

DISTURBANCES DUE TO DISEASE OF THE VERUMONTANUM AND ITS TREATMENT WITH THE POSTERIOR URETHROSCOPE.*

BY GEORGE KNOWLES SWINBURNE, M D,
OF NEW YORK

WORK upon the posterior urethra through the urethroscope during the past eight or nine years has convinced me that it is a valuable aid and a distinct advance in the treatment of trouble in that portion of the genito-urinary tract, and that many obscure symptoms may be found to be due to disease or to some pathological condition of the verumontanum, or of the urethral floor in its immediate vicinity

The most common cause of trouble in this part is, of course, chronic gonorrhœa, though I have had a large number of non-venereal cases in which trouble with the verumontanum seemed to be the disturbing element. The association, further, in many of these cases of an oxaluria has made me believe that this might be a factor in the pathogenesis of both these classes of cases. At the same time, while in some cases of oxaluria attention to the digestive tract has been sufficient to clear up the symptoms, in others the symptoms have persisted until the posterior urethra has been treated through the urethroscope. The following case seems to me to be typical of this condition

B D, 19 years old, consulted me as recently as March 14, 1908. For three years he has been troubled by persistent and frequent nocturnal emissions, constipated habit, facial acne, clammy hands. Has been obliged to give up studies which he was pursuing at night, while working during the day, so that he feels he can make no advance, unless his condition can be relieved

* Read before the American Association of Genito-Urinary Surgeons, May 1, 1908

During this time has been almost constantly seeking relief of one physician after another. During the week preceding his coming to consult me, had had emissions every night. The urine was loaded with oxalate of lime crystals. Never had venereal disease. There was a slight mucoid discharge which can be squeezed out of the urethra, contains bacteria, but no gonococci. The prostate and vesicles reveal nothing to the examining finger. Examination of the posterior urethra showed the entire verumontanum to be much swollen, very hyperæmic, bleeding very easily on touch with the cotton swab, and also on relief of pressure as the mucous membrane comes up into the window of the instrument during its gradual withdrawal. The entire floor of this portion of the canal was freely swabbed with a 10 per cent solution of silver nitrate, or what is practically the same thing, argentamine in full strength. Attention was also paid to the digestion with a view to eliminating the oxaluria. The patient received five such applications at weekly intervals. At the last examination on April 11th the verumontanum was perfectly normal as seen through the urethroscope, it was not hyperæmic, it did not bleed. The oxalate of lime crystals were not found after the first examination and during these four weeks he had had but one nocturnal emission.

I do not mean to say that this case is by any means cured, but a healthier condition of the posterior urethra, especially the verumontanum, has been brought about more quickly than by any means with which I am acquainted, and it so clearly illustrates one phase of this condition, that of the simplest, that I cite it here.

In my experience this has generally been the condition of the verumontanum which has been found in these non-venereal cases—a swelling and a hyperæmia of the entire verumontanum and a marked tendency to bleed easily.

In the cases which have been dependent upon a chronic gonorrhœa there has been a great variety in the urethroscopic picture as well as in the symptoms. In many of the cases in addition to the hyperæmia and swelling which is almost always present with the tendency to bleed on slight touch, there is a real hypertrophy as if due to a round-cell infiltration, and there is irregularity in the shape of the verumontanum and

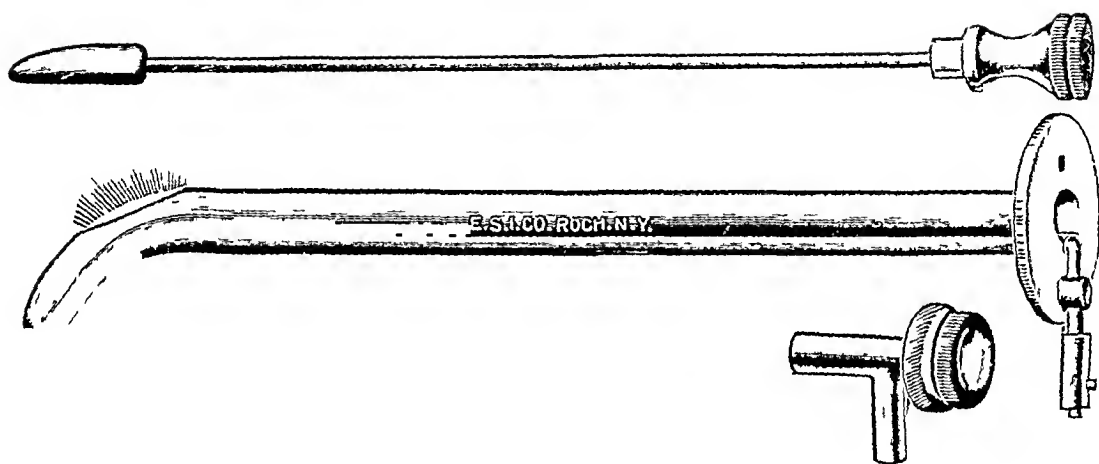
variations in the appearance of the surface of the mucous membrane, in some cases dull and dry and deeply reddened, or the surface is granulating, or there is a small granulation patch here, and there a small area looking like a bit of raw beef, and the general surface very irregular. There may be small excrescences looking like polypⁱ springing from the surface of the verumontanum, there may be a small granulation tumor, a granuloma. This latter condition I have met with in two cases, and I can recall but two cases in which I have met with polypⁱ.

The symptoms vary, there may be a simple mucoid or mucopurulent drop in the morning, or this condition may be constant without other symptoms. The urethra, on the other hand, may be perfectly dry. There may be a neurasthenic condition of any varying degree, and it may in some cases be accompanied by frequent nocturnal emissions and even diurnal. The seminal secretion may be blood-stained. There is in some cases—and this, I think, I have found in the majority of the cases—premature ejaculation or there may be complete impotence. Some of the cases complain of pain, this may vary from a slight feeling of discomfort along the urethral canal, or a tickling or a burning sensation, to a sharp lancinating pain. This pain or discomfort may, in some cases, be referred to the navicular fossa, or to the perineum, or to the deep urethra in front of the rectum, or over the pubes, sometimes over the sacrum. It may not be of great severity. In some cases there may be pain in the deep urethra, as if a foreign body were present. These pains are generally independent of the act of urination, or the pain may come only at the end of urination. Neuralgia of the testicle or in the sciatic region I have met with.

I have not attempted to give a complete account of all the symptoms which seem to be due to disease of the verumontanum, but only the most prominent and characteristic. I have presented this paper with a view to exhibiting to this society my instrument, already no doubt well known to you, to give

the reasons why I believe it to be the most practical working instrument to-day for dealing with the posterior urethra, finding, the more I have worked with it, the more satisfactory it has become. It was after considerable experience with the straight tube in the posterior urethra with the cold lamp, that I felt that a curved tube would prove more comfortable to insert, and it was in November, 1900, that I first ordered an instrument so constructed. The first sent me had the light in the beak, as in the aero-cystoscope, I then saw that the light must be in front of the window for proper illumination, as the floor of the urethra filled the window and the mucous membrane was illuminated by transillumination. In January, 1901, I obtained the first practical instrument, the beak was left hollow, however, and my experience with one case, which is related below, led me to have this remedied. The first method to remedy this, was to fill the beak with cement, which was not satisfactory, afterwards it was filled with metal, as in the present instrument (Fig 1). Three sizes were made 24, 26 and 28 F, but of late years I find I use the size 24 almost to the exclusion of all others. An objection made to the instrument has been that one could not see lesions on the roof of the posterior canal. In working with the straight tube, I never saw any lesions in the roof. Most of the lesions are about the verumontanum. I have also come to prefer an instrument in which the Koch auxiliary chamber keeps the lamp out of the way, when treating the mucous membrane. I have had instruments made, in which the lamp was in the tube itself, for use either with the Chetwood lamp or the Otis light, but the Chetwood lamp interfered with swabbing, and the Otis light in my hands does not give as good illumination, nor is it so convenient in treating cases. In one instrument there was an attachment with window, so that air dilatation could be used in the posterior urethra, but I have not found that the surface is any better illuminated, lesions cannot be treated without removing the apparatus, and then, too, any moisture in the canal is blown through the chamber carrying the light, which interferes with

FIG 1



Posterior urethroscope

vision and might be productive of danger to the eye of the operator. Though this could be obviated, I have not attempted to do so.

In inserting the instrument, the patient lies on the table, hips slightly raised, the lamp is tested before being placed in the instrument, then the cord is detached. While inserting it I stand on the patient's right and insert the instrument as in passing a sound. When the beak reaches the cut-off, I change the instrument from the right to the left hand, pressing down above the pubes with the right hand, while with the left I gently push the instrument into the deep urethra until it has reached the point I wish, which should be so that the very posterior tip of the verumontanum with the portion of urethra posterior to it will come into the window. The cord is then attached, the broad shield is grasped between the finger and thumb of the right hand and held perfectly still, the wrist and palm of the hand resting on the symphysis, and then I gently withdraw the obturator. If the instrument has not been inserted far enough,—I can tell this by the appearance,—I often push the instrument deeper while looking through it at the window, without reinserting the obturator. If the instrument has passed too deep, and there is urine in the bladder, it will come into the tube. If there are only one or two drops, it can be removed with the cotton swab, if more comes, I withdraw the instrument and reinsert it.

Almost the only treatment which I have applied to the posterior urethra has been a 10 per cent solution of silver nitrate or argentamine in full strength. In the March number of the *Zeitschrift f Urologie*, 1908, p 219, I have noted that Wossidlo, of Berlin, in an article on this subject, has used 20 per cent silver nitrate and in some severe cases has used the electrocautery, applying it directly to the diseased portion. In this article Wossidlo presents an instrument very similar to mine, but the lamp is in the same chamber, and for that reason I do not think it as practical, furthermore, the manner of inserting the light renders the calibre through which the applications are made, smaller than the calibre of the tube. I

should think, however, that for granuloma or polyp the electrocautery would prove an excellent aid

The manipulations, of course, are done under aseptic precautions. There is no after-pain in making application with this strong solution of silver nitrate and, as a rule, no discomfort except for the burning sensation at the next two or three times of urination, even though the cotton swab is soaked with the solution and freely applied, whereas I think, all will acknowledge the extreme discomfort of silver nitrate in much weaker solution, when applied through the instillator, an instrument I but very seldom use now. Furthermore, the latter is applied in the dark and does not reach the whole of the portion intended. Then, too, I have treated and cured many cases with the urethroscope that had had the instillation method applied for months by other operators.

I never use the urethroscope while gonococci can be demonstrated to exist, and seldom use it for treatment until all other pathological conditions, as trouble in the anterior urethra or prostatitis and seminal vesiculitis, have been removed so far as possible. These lesions are always treated until they seem incapable of further improvement, then, if the case seems to need it, I employ the urethroscope. I have sometimes had cases in which the gonococcus for a long time could not be demonstrated, one case I remember, in which marriage had been sanctioned by two competent men, in which after one or two or more applications through the urethroscope, a urethral discharge started up containing gonococci, and that, too, without further exposure to infection. When this has happened, and it has happened often enough for me to be on the lookout for it, I refrain from further use of the urethroscope until the trouble subsides. I have noted in some cases, having as a symptom frequent nocturnal emissions with an accompanying vesiculitis and prostatitis, that, while at first massage and treatment directed to these parts helped that symptom, it would return again, even while the treatment was carried on. In my experience these cases need treatment with the urethroscope.

The treatment is carried on by making the application once a week only—seldom have I ever made the intervals shorter, though in a few cases I have made them at intervals of five days. The average number of treatments has varied from three to twelve, sometimes more, but in such cases the intervals have been lengthened to once in two weeks and even longer as the condition has improved.

The following cases present interesting points

CASE I—H. B., 26 years old, was treated for an acute gonorrhœa in the spring of 1899,—it was his second attack. His first attack had occurred six years before and he had always after that suffered from its results. The present attack followed the only exposure since the first attack. Following his first attack he had had a double epididymitis, which occurred nine months after its beginning. After that he had had an internal urethrotomy performed, after this he suffered a good deal from neuralgia of frequent recurrence in the left testicle, had been treated for prostatitis and seminal vesiculitis by massage, without benefit to the condition of neuralgia. When he came to me, he had had these attacks of neuralgia for four years. He presented a mild degree of neurasthenia, and strongly objected to any urethral instrumentation, as he had had so much of it without benefit and had suffered much pain in consequence. Nevertheless, after his gonorrhœa had subsided, I persuaded him to consent to a urethroscopic examination of the posterior urethra. The verumontanum was much enlarged and the anterior half presented a granulating patch which I swabbed freely with a 10 per cent solution of silver nitrate, and thereafter made five or six similar applications a week apart. He never had a return of the neuralgia after the first application, and at the last application the urethra presented a normal aspect.

The difficulties met with in this case especially brought me to consider the instrument which I had made.

CASE II—A. M., 29 years old, came to the dispensary in the latter part of 1900, having a chronic gonorrhœa. Had recently come out of the hospital, where he had been laid up with double epididymitis. He had lost flesh and strength, his urine was very cloudy, his prostate was very much enlarged and he was still under treatment for his epididymitis. He suffered from consider-

able pain in the deep part of the canal, and in January, 1901, I examined him with the posterior urethroscope, he being one of the first cases on which I had used it. The passage of the instrument caused much pain, on withdrawal of the obturator the verumontanum came into the window. It was much hypertrophied, the surface was granulating, and in its middle portion appeared a small tumor like a granuloma. The surface was thoroughly swabbed, but on withdrawing the instrument, the tumor was found to have been curetted off and was in the beak of the instrument. It was followed by only a slight amount of bleeding, and several applications were made after this, and the patient was greatly improved and disappeared. Subsequently, five years later, he presented himself at my office, having an oxaluria, and, in conjunction with treatment for that condition, I had occasion to treat the posterior urethra for a congested condition making about four or five applications. Outside of this condition the canal was normal, and it was interesting to see it so many years after a considerable pathological condition had existed.

It was the accident occurring in this case which fortunately was a beneficent one, which led me to have the beak of the instrument filed to prevent a similar subsequent occurrence.

In many of these cases which I have thus treated, I have had occasion to re-examine the urethra after a longer or shorter interval following a course of treatment, and have been struck by the normal appearance of the verumontanum.

When I began urethroscopy of the posterior urethra, I feared the possibility of one accident, hemorrhage into the bladder from a profuse bleeding from this surface, but as time went by and no such accident occurred in any of the very great number which I have treated—I have the records of over a hundred cases during that time in my office practice and certainly many more in my dispensary work—I began to think this danger a slight one. Nevertheless, it did occur in the practice of one of my assistants last year. One Sunday morning, about eight o'clock, he telephoned me he was sending up a patient he wished me to see. The man came to my office suffering extreme pain. He had a constant tenesmus, made constant efforts at urination, and only a few drops of blood

passed. The distended bladder could be felt above the symphysis, a hard mass the size of a cricket ball, pressure over this tumor increased the pain immensely. Before sending him into a hospital, I thought I would see what could be done to relieve him. I passed a silk-woven catheter into the bladder, drawing off only a little blood, and then washed out the bladder as gently as possible with a warm solution of alphozone (quite hot), following this with a weak solution of peroxide, and then finished with a weak solution of adienalin. Although the bleeding was not entirely stopped, he was much more comfortable, after I had succeeded in removing all the clots and while doing this elicited his history. For some time previous he had had massage of his prostate and then was subjected to a course of treatment with the urethroscope, having been treated with it about seven times in all, the last one being on the previous afternoon, when he was told that there was no more need of treatment. No bleeding had followed this last treatment, and at ten o'clock that evening he had passed a perfectly clear urine, but at one o'clock in the morning, while at work (he was a baker), he had occasion to urinate, when he was much frightened to find he was passing what appeared to be pure blood. This was quickly followed by the sensation of a full bladder and constant efforts to urinate with the passing of blood, until he was sent to me that morning.

I gave him urotropin and sent him home to bed, and visited him that evening, he had, during the day, passed rather frequently blood-tinged urine, but no blood or clots; he was very sore. The urine continued blood-tinged for forty-eight hours, then passed away. Two weeks later I made a cystoscopic examination of the bladder and found it normal.

FIBRINOUS CALCULI IN THE KIDNEY

BY HOMER GAGE, M D , and HOWARD W BEAL, M D ,
OF WORCESTER, MASS

IN considering urinary calculi, we are accustomed to think of the difference in consistence between the hard uric acid and oxalate of lime calculi, and the softer stones composed of the alkaline phosphates, the former so hard as to offer great resistance to the lithotrite, the latter crumbling easily

But we are apt to forget that there are other bodies even softer, whose definite form and infiltration with crystalline deposits, bring them within the general classification of urinary calculi. They are sometimes spoken of as "blood calculi," "fibrinous concretions" or "colloid stones,"—are not very common, and the number of reported cases is very small. Their variety, and their bearing upon the theories in regard to the formation of urinary calculi, would seem to make them of enough interest and importance to warrant a brief description of such a case which came under our observation in 1906

Miss A C, 56 years old, was referred to the Memorial Hospital May 20, 1906, by Dr P T O'Brien, of Clinton, Mass. Her father died of typhoid fever, her mother of "heart disease"—there is a history of tuberculosis on the father's side, but none in the immediate family, five sisters and one brother are dead, one after a long illness, at 24 years, nature not known,—the others, all from acute infectious diseases. The sister who is living, has been "troubled with gravel and has passed hard stones," but is now in excellent health, 60 years old.

She had pneumonia at seven, was sick two or three months, and has ever since been subject to coughs, has occasionally had a bloody expectoration. Had typhoid at 17, and jaundice at 19.

For several years was troubled with indigestion, pain in epigastrium and nausea, and in 1902, was jaundiced again. On September 6, 1902, at Memorial Hospital, she was found to have

an enlarged gall-bladder easily seen and felt, with the liver extending three inches below the level of the ribs, a gall-stone was found obstructing the cystic duct, and was successfully removed. Menstruation had ceased when she was 50 years old.

From the time she was 15 years old, until she was 30, she passed gravel in the urine—a gray-colored sand, that settled in bottom of chamber, would not wash out, and often had to be scraped out, none of this between 30 and 35, but in February, 1885, while dressing, was taken with severe pain in right side of back, with urgent desire to urinate. The urine was dark blood color, with small clots. During the morning, urinated every 15 to 30 minutes and the dark color of the first urine gradually changed to a bright blood color. Three days later the blood and increased frequency had disappeared, and the urine had become normal.

Two months later, after walking up a hill, had a second attack of pain, similar in character, but much less severe than the first, lasting but a few days, blood showed in urine twice on first day of attack. The next winter, 1885-1886, for two or three months, had several attacks of pain along line of right ureter, these occurred in day or night, often with several weeks between, lasting several hours, and disappearing gradually.

These attacks were always accompanied by smoke-colored urine, in which was a sediment of "a black, smoky dust." During the period in which these attacks occurred, she was unable to start quickly, reach far above her head, or go up a hill without inducing pain in her right side. Once in reaching for a picture, hanging on the wall, she was taken immediately with a pain which began one of these attacks.

From that time until 1904, she felt pretty well, did considerable work about the house, and had little or no trouble with her side. In 1902, at the time of her cholecystotomy, examination of the urine showed that it had a specific gravity of 1017, was acid, contained a very faint trace of albumin, no sugar, and in the sediment a few leucocytes and a few red blood corpuscles. On the day following the operation, there were also numerous epithelial and granular casts.

Present Illness—Two years ago, while riding in an electric car, felt annoying pain in right back, extending down right side toward bladder. Urinated once an hour urine contained no

blood, but was thick and ropy. Similar attacks, beginning with severe, sudden pain, and lasting five or six days, recurred at irregular intervals, until present.

These attacks confined her to bed, and were accompanied by chills, fever and vomiting. For several months the attacks were infrequent, but toward spring increased in frequency, lasted longer, and were more severe. In August, 1905, she passed four small stones and from then until the time of the operation, thinks she passed between 30 and 40, some as large as a good-sized bean.

Miss C. was very thin, skin had a yellowish color, tongue was coated, breath sounds were harsh on the left side anteriorly, heart was normal. There was marked tenderness on the right side of the abdomen, but the right kidney was but indistinctly felt, tender, but not enlarged. Pulse, 68, temperature, 98.5°, respiration, 20.

The urine, on entrance, had a specific gravity of 1020, was alkaline, had a faint trace of albumin, no sugar. In the sediment were no casts, and no blood, many bacteria, mucus, few leucocytes, epithelial cells, amorphous phosphates and dicalcic phosphatic crystals.

A cystoscopic examination of the bladder was made on the 26th of May, by Dr. H. W. Beal, with the following results.

Nothing abnormal noted in appearance of bladder. Twenty-seven c.c. of urine were withdrawn by catheterization of the ureters from each kidney, that withdrawn from the right kidney was yellow, alkaline, sp. gr. 1010, it contained a distinct trace of albumin, no casts, numerous amorphous urates, no tubercle bacilli, but many uric acid crystals, epithelial cells, bacteria and pus-cells, with a few red blood corpuscles. From the left kidney, amber, acid, sp. gr. 1026, with marked trace of albumin, uric acid crystals, epithelial cells, and red blood corpuscles.

In spite of the presence of red blood corpuscles and epithelial cells in the urine of the left kidney, inasmuch as the amount of urine and its specific gravity were satisfactory, it was determined to cut down upon the right kidney, which had been the constant seat of the pain, and from the presence of the pus-cells and bacteria, was evidently the seat of a marked pyelitis.

Accordingly, on June 1, 1906 the kidney was exposed through a six inch lumbar incision, its external appearance was normal but the pelvis and upper end of ureter were markedly

dilated, a small incision revealed the presence of numerous calculi in pelvis of kidney, extending well down into the ureter. The kidney was removed entire, and the end of the ureter was sutured to the skin.

The operation was done under gas-ether, and occupied 35 minutes, her convalescence was delayed by a severe bronchitis, and some superficial suppuration, so that she did not leave the hospital until July 3, 1906, five weeks after the operation.

Examination of the urine, made after the operation, showed always a distinct trace of albumin, a specific gravity ranging from 1010 to 1024 a few hyaline casts on the second day, none afterwards, and always many leucocytes. Four weeks after the operation, she was passing 13.68 Gm. of urea in 24 hours.

She was re-admitted to the hospital August 27, 1906, with a sinus six inches deep in the line of incision, this sinus was enlarged, curetted and packed with iodoform gauze, it was entirely healed, and she returned home on September 17th. At this time, her urine still contained a large trace of albumin, and many leucocytes. A catheterized specimen was not obtained.

Subsequent History—At the present time, Miss C reports that her general health has been very much better since the operation, that she has weighed more than for five or six years past, and that she has been able to work. She looks well, and physical examination reveals nothing abnormal. She passes about 24 oz. of urine in the 24 hours, and has no increased frequency, and no pain.

Examination of urine, obtained per catheter, showed normal color, acid reaction—specific gravity, 1014. Albumin, by nitric acid absent, by heat test, a slight trace. Sediment, obtained by centrifuge, showed an occasional leucocyte, and very few bacteria—amount of urea was 1 per cent.

We think it may be safely inferred, that the remaining kidney presents none of the pathological conditions which characterized the one which was removed. Examination of the kidney after its removal showed that the capsule was not adherent and the renal substance was but little thickened, the pelvis of the kidney was tensely distended and completely filled with clay-colored bodies which turned brown after exposure to the air, were of the consistency of moderately hard putty, and varied in size from a large bean to the head of a pin.

There were 10 or 12 large ones, and a great many smaller ones, more than 100 in all, all, even the smallest, presented smooth, faceted surfaces, like those of gall-stones. Their general appearance, as they lay in the pelvis, and extended down into the ureter, is admirably shown in the accompanying drawing.

The specimen was subsequently sent to Dr F B Mallory, whose report is as follows

"Specimen consists of kidney, incised through the hilus, and preserved in alcohol. The kidney is a little enlarged, and the pelvis and beginning of the ureter are considerably distended. The latter contained in the fresh state many soft, more or less rounded, reddish-gray masses, some of which are still attached to the calices of the kidney, the others are free in the alcohol (Figs 1 and 2)

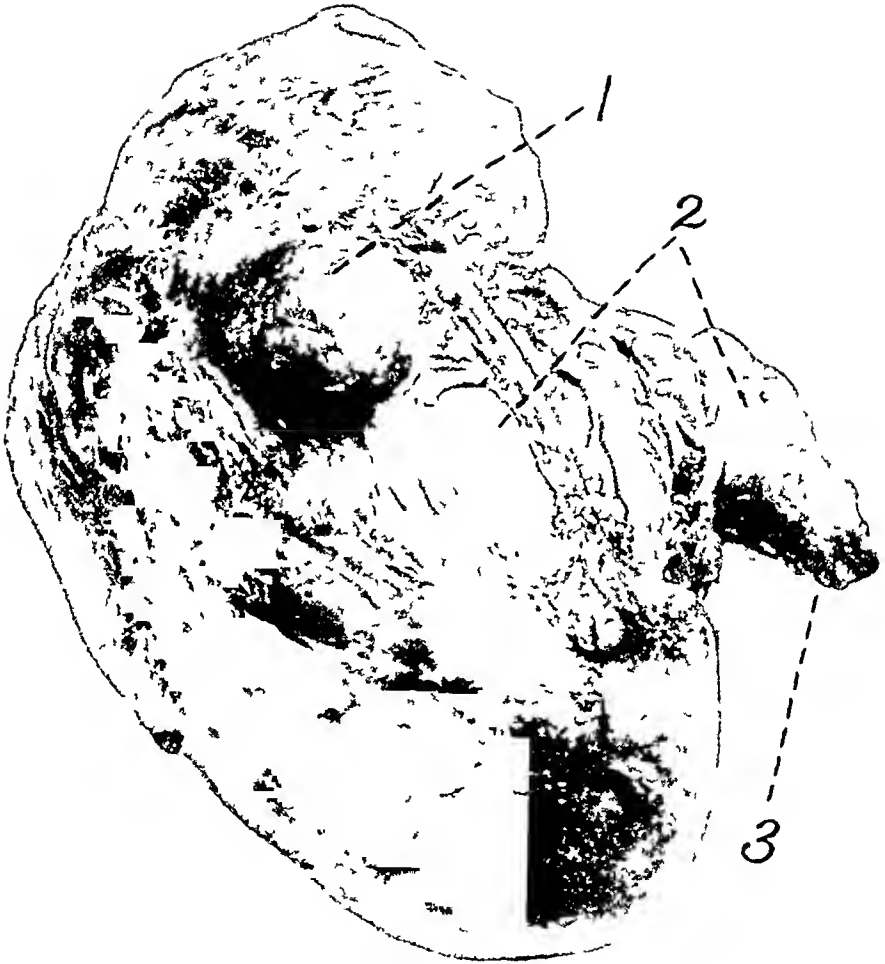
"They vary very much in size, the largest received measures $18 \times 13 \times 0.9$ cm. They are irregular in shape from pressure against each other, are easily broken up, and seem to be composed of thin layers. Microscopically, after decalcification the material seems fairly homogeneous, but it shows a concentrically laminated arrangement, and in places there is a meshwork, evidently composed of fibrin threads, out of which each calculus is probably formed."

Some of the calculi were sent to Dr R L Emerson, to determine the nature of the infiltrating salts, who reports "The renal calculi which I received from you July 16th, are composed chiefly of calcium phosphate. There was mixed with the calcium phosphate, more or less altered blood which tended to cover the stones at various times during their formation and accounts for their more or less concentric appearance. I could get no test for uric acid, triple phosphate, or calcium oxalate."

These calculi consist, therefore, of alternating layers, concentrically arranged, of calcium phosphate and fibrin, and may be properly classified as fibrinous calculi.

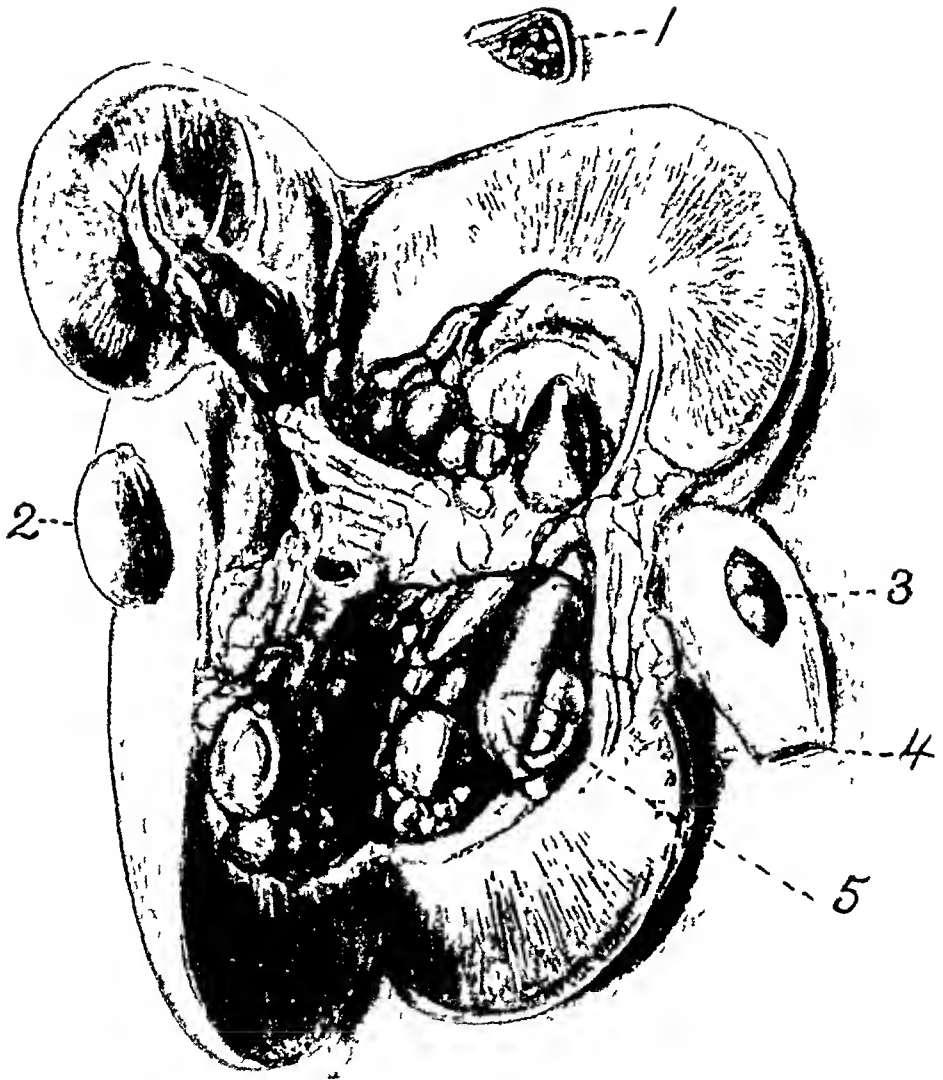
The first mention that we have been able to find of fibrinous calculi, occurs in Marcet's "Calculous Disorders" (1817), in which he says of a calculus sent to him by Sir Astley Cooper, that "It was neither cystic nor uric, but that it appeared to consist of hardened animal matter, probably of the albuminous kind, that upon closer examination its properties correspond exactly to those of fibrin, and therefore if the occurrence of similar concretions should render it necessary to give them a name, they might, I think, without impropriety, be called fibrinous concretions." The patient from whom this

FIG 1



1 Surface cyst 2 Pelvis and upper end of ureter distended with calculi 3 Cut ureter

FIG 2



1 Section of calculus 2 Surface cyst 3 Window showing pelvic portion of ureter crowded with calculi 4 Cut ureter 5 Pelvis of kidney dilated and crowded with calculi

specimen was obtained, had already passed three calculi of similar character, and all nearly the same size, viz, "Size of a pea"

In 1837, Dr Hodgkin described two calculi taken from the bladder of a boy, aged two years, and the description is so like the calculi found in our case, that it seems worth repeating

"Instead of presenting the hardness and resistance of solid bodies composed of earthy matter, they possess, on the surface at least, a degree of softness and elasticity, as if covered with a fleshy layer. The material of which the surface was composed, exhibited a slight degree of translucence, not unlike that of some blighted acephalocyst membranes. These unusual characters induced at first some doubt respecting the nature of these bodies

"Section made through one of them, showed that they in part consisted of an opaque white substance, having an earthy texture arranged in concentric but fragile layers. Two or three thin layers, consisting of a material precisely similar to that of which the external coating of the calculi was composed, were situated between the layers possessing the earthy character

"Although the earthy layers were so brittle as to be crushed by the act of making the section, the fragments were so completely retained in their relative situations by the tenacity of the membranous layers, that the two portions into which the calculus was divided, were able to retain their form and cohesion"

Dr Hodgkin believed that, "A nucleus existing in the bladder at the time became invested with coagulated fibrin, as a stick does when agitated in recently drawn blood, that when the character of the urine again changed the deposition of phosphates took place and inclosed the fibrinous layer"

The repetition of these occurrences appears sufficiently to account for the production of these calculi, and to be strictly analagous to the process by which other alternating calculi are formed

Civiale refers to bladder masses which have to be exposed before they can be recognized as true semifluid calculi, in which the animal matter greatly exceeds the mineral matter, and further, of small gravel stones of soft consistency, combined with a large quantity of semiliquid substance

His references are plainly to the thick mucus, which he says often dries outside the bladder in dirty gray scales and can collect on the surface of a vesical calculus and there pro-

duce a real horny layer. He also mentions a fibrinous calculus, the size of a bean, yellow, and half transparent, which was extracted from the bladder of a cadaver by Sir Benjamin Brodie. It had the appearance of amber, lost much of its volume in drying, and its presence had not been suspected during life.

In 1857, J. Scott Alison, in examining the body of a man who had died of consumption, found "the left kidney to be greatly atrophied, changed in structure, and to have the infundibula and pelvis stuffed with hard bodies, most of which are of a coal black color. The largest of these is the size of a horse bean, looks somewhat worn and disintegrated, and at one point resembles a piece of decayed wood. At one side it is black from the pressure of altered blood. It is very light in weight, and is composed of blood and phosphate of lime."

To these he gave the name of blood calculi, and explained their formation by the presence of an "inflammatory action, set up perhaps by the pressure of small calculi of phosphate of lime. Blood was probably effused in consequence, and from suppression of urine, remained in the infundibula and pelvis, and failed to be washed down the ureter. This blood hardening, would form the calculi which were discovered."

Roberts, in his "Treatise on Urinary and Renal Disease," refers also to calculi of inspissated blood, and refers to a case in which several such concretions were found loose in the infundibula and pelvis of a kidney which had been ruptured by external violence. These seem to have contained little or no earthy matter, but he says, "Such concretions sometimes serve as nuclei for uric acid or oxalate of lime calculi."

Generisch, in 1903, showed "a colloid stone from the renal pelvis, found in a 39-year-old porter, granular contracted kidneys, and cardiac hypertrophy were present."

"The calculus is the size and shape of a castanea nut, tapering at one end, measuring $32 \times 29 \times 24$ mm, weighing 13.9 Gm. The surface is smooth, with the exception of protuberances the size of a bean in two places. The color is grayish-brown, somewhat translucent. A needle can be inserted 4 mm deep into the calculus, when it strikes a hard nucleus.

"On section, the calculus shows a hard nucleus, the size of a hemp-seed, formed of black calcium oxalate, surrounded by a softer light red layer of uric acid. The latter was followed by a firm layer of calcium oxalate, which in turn was surrounded by a yellowish mantle of urates."

The tetrahedral nucleus described above, "was covered with a colloid layer, in the form of scales and lamellæ, which could be scraped off with the finger-nail or cut with a knife." He goes on to say, "that the colloid covering of the calculus seems to give a hint as to the growth of calculi in general."

"The scales and lamellæ point to the conclusion that the organic formed substance of the calculus is deposited first, and the inorganic substance added later. On the other hand it is not impossible that a colloid layer might have been deposited in the renal pelvis, secondarily and independently of the calculus formation, as we are dealing with a case of contracted kidneys in which there is abundant formation of colloid substance."

In 1904, Dr Elliott, of Boston, published an account of two fibrinous concretions successfully removed from the bladder of a man 54 years of age. "They were of a lightish-yellow color, with smooth surfaces, slightly wrinkled, and of the consistency of firm putty. The structure was homogeneous, slightly gritty, giving the impression of coagulated material, fibrin and mucus mixed with particles of urinary salts, in the centre of which was a small nucleus, composed chiefly of calcic phosphate."

In 1906, appeared an article by Dr Piollet, on "Calculous Pyonephrosis with Abnormal Organic Concretions—Lumbar Nephrostomy—Recovery." The essential features of this most interesting case were the removal, by incision of the kidney, of half a litre of thick, yellow, fetid pus, about 50 dark soft concretions, and two round hard calculi.

These soft concretions varied in size from that of a grain of wheat to that of a large nut. They were elastic, like rubber, in shape, generally round, with facets flattened by reciprocal pressure. They proved to be almost entirely composed of organic matter in concentric layers, albuminoids and fibrin. The ashes were composed of phosphates, in very small quantities.

The similarity between the calculi described in these re-

duce a real horny layer. He also mentions a fibrinous calculus, the size of a bean, yellow, and half transparent, which was extracted from the bladder of a cadaver by Sir Benjamin Brodie. It had the appearance of amber, lost much of its volume in drying, and its presence had not been suspected during life.

In 1857, J. Scott Alison, in examining the body of a man who had died of consumption, found "the left kidney to be greatly atrophied, changed in structure, and to have the infundibula and pelvis stuffed with hard bodies, most of which are of a coal black color. The largest of these is the size of a horse bean, looks somewhat worn and disintegrated, and at one point resembles a piece of decayed wood. At one side it is black from the pressure of altered blood. It is very light in weight, and is composed of blood and phosphate of lime."

To these he gave the name of blood calculi, and explained their formation by the presence of an "inflammatory action, set up perhaps by the pressure of small calculi of phosphate of lime. Blood was probably effused in consequence, and from suppression of urine, remained in the infundibula and pelvis, and failed to be washed down the ureter. This blood hardening, would form the calculi which were discovered."

Roberts, in his "Treatise on Urinary and Renal Disease," refers also to calculi of inspissated blood, and refers to a case in which several such concretions were found loose in the infundibula and pelvis of a kidney which had been ruptured by external violence. These seem to have contained little or no earthy matter, but he says, "Such concretions sometimes serve as nuclei for uric acid or oxalate of lime calculi."

Generisch, in 1903, showed "a colloid stone from the renal pelvis, found in a 39-year-old porter, granular contracted kidneys, and cardiac hypertrophy were present."

"The calculus is the size and shape of a castanea nut, tapering at one end, measuring $32 \times 29 \times 24$ mm, weighing 13.9 Gm. The surface is smooth, with the exception of protuberances the size of a bean in two places. The color is grayish-brown, somewhat translucent. A needle can be inserted 4 mm deep into the calculus, when it strikes a hard nucleus.

"On section, the calculus shows a hard nucleus, the size of a hemp-seed, formed of black calcium oxalate, surrounded by a softer light red layer of uric acid. The latter was followed by a firm layer of calcium oxalate, which in turn was surrounded by a yellowish mantle of urates."

The tetrahedral nucleus described above, "was covered with a colloid layer, in the form of scales and lamellæ, which could be scraped off with the finger-nail or cut with a knife." He goes on to say, "that the colloid covering of the calculus seems to give a hint as to the growth of calculi in general."

"The scales and lamellæ point to the conclusion that the organic formed substance of the calculus is deposited first, and the inorganic substance added later. On the other hand it is not impossible that a colloid layer might have been deposited in the renal pelvis, secondarily and independently of the calculus formation, as we are dealing with a case of contracted kidneys in which there is abundant formation of colloid substance."

In 1904, Dr Elliott, of Boston, published an account of two fibrinous concretions successfully removed from the bladder of a man 54 years of age. "They were of a lightish-yellow color, with smooth surfaces, slightly wrinkled, and of the consistency of firm putty. The structure was homogeneous, slightly gritty, giving the impression of coagulated material, fibrin and mucus mixed with particles of urinary salts, in the centre of which was a small nucleus, composed chiefly of calcic phosphate."

In 1906, appeared an article by Dr Piollet, on "Calculous Pyonephrosis with Abnormal Organic Concretions—Lumbar Nephrostomy—Recovery." The essential features of this most interesting case were the removal, by incision of the kidney, of half a litre of thick, yellow, fetid pus, about 50 dark soft concretions, and two round hard calculi.

These soft concretions varied in size from that of a grain of wheat to that of a large nut. They were elastic, like rubber, in shape, generally round, with facets flattened by reciprocal pressure. They proved to be almost entirely composed of organic matter in concentric layers, albuminoids and fibrin. The ashes were composed of phosphates, in very small quantities.

The similarity between the calculi described in these re-

ports, and those found in our own case, will be readily observed. In none were so many found, however, as in our patient, and in but one, was the smooth, faceted appearance noted, such as is commonly found in gall-stones. Most of them present a framework of fibrin, in which have been deposited crystals of phosphate of lime.

If we accept Rainey's theory of the formation of urinary calculi by molecular coalescence, a theory which has been further elaborated by the observations and experiments of Ord and Ebstein,—these differ from the more common calculi simply in having a large excess of the colloid or cement in which the inorganic salts of the urine are deposited,—from the great predominance of this cement, we are able easily to demonstrate that it is made up of fibrin, and not of mucus, pus, or other albuminoids.

The origin of this fibrin in our own case, as is believed usually to be true of fibrinous calculi, lies in a previous hæmaturia, which from the patient's history, occurred at several different times, and quite profusely a few years before she came under our observation.

The cause of the hæmaturia is not clearly established by the examination of the kidney, and we have no means of knowing whether the bacterial invasion of the renal pelvis preceded or followed the hemorrhage.

BIBLIOGRAPHY

- ACKERMANN Ein fall von parenchymatöser Nephritis mit Retention der Cylinder in den Nierenbecken und im Nierenbecken, *Deut Arch f klin Med*, Leipz, 1872, x 298-300
- ALISON, J S Blood Calculi in a wasted Kidney (one case), *Arch Med*, Lond, 1859, 1, 246-248
- CIVIALE Traite de l'affection calculeuse, Paris, 1838, p 26-45
- CURNOW, JOHN Atrophied Kidneys with impacted Calculi, *Trans Path Soc*, London, vol 24, 1873
- D'ETOILLES, FILS, L *Traité pratique de la gravelle et des calcul urinaires*, Paris 1866
- ELLIOT, J W Fibrinous vesical concretions (report of a case in which two large fibrinous concretions were removed from the urinary bladder), *Ann Surg*, Phila, 1904, 39, 256
- GENERISCH, A Ein colloid Stein aus dem Nierenbecken (two cases), *Pester med chir Presse*, 1904, 40, 1892

- HODGKIN Description of a remarkable specimen of urinary calculus,
Guy's Hosp Rep, Lond, 1837, 11, 268-278
- KAUFMANN Specielle pathologische Anatomie, 1901, p 732-733
- MARCET, A An account of two calculi which cannot be referred to
any of the species hitherto described In his "Essay on the
chem hist. and treatment of calculous disorders," London, 1817,
1895
- MOORE, W D Urinary calculi, consisting of Heller's Urosteolith, Dub
Quart, J M Sc, 1854, 17, 473-476
- MORRIS, H Renal Calculus, in his "Surg Dis Kidney and Ureter,"
Lond, 11, 43-171
- PEIFERS, A Ueber eine besondere Form von Nierensteinen, Munc med
Woch, 1894, 40, 531-532
- PIOLLET Pyonephrose calculeuse avec concretions organiques anormales,
nephrostomie lombaire, guerison, Centre med et pharm, Gannot,
1905-1906, 40 545-548
- QUAIN, R Quasi organized fibrin discharged by the urethra, Tr Path
Soc, Lond, 1852-1853, 4, 205
- ROBERTS, W Practical treatise on Urinary and Renal Diseases, Lond,
1885, 4 ed 323-330
- VALENTIN, G Ueber Bildung anorganischer Concretionen in organischer
Theilen Arch f anat Phys u Med, Berl, 1836, 256

HÆMATURIA AS A COMPLICATING FACTOR IN APPENDICITIS

BY M G SEELIG,

OF ST LOUIS, MISSOURI,

Associate Surgeon of the Jewish Hospital, Assistant Professor in Surgical Pathology
in the Medical Department of St Louis University

THE following three cases illustrate the practical difficulties encountered as a result of the development of hæmaturia due to appendicitis

CASE I—P F, 28 years old, a native of Russia, gave a negative family and past history. Present history dates back three months, during the course of which time he had two acute attacks of abdominal pain. These attacks had been diagnosed as appendicitis by a New York surgeon who had also advised operation. A week before admission to the Jewish Hospital of St Louis he had a similar typical attack of acute appendicitis. When the patient entered the hospital all acute symptoms had subsided, and the physical examination was negative except for a slight residual tenderness over McBurney's point. The urine at this time was free from all pathological elements. Preparation for appendicectomy was ordered, but about eighteen hours before the time set for operation the patient suffered excruciating pain in the right lumbar region. His temperature rose a degree and a half, but his pulse-rate remained normal. There was only minimal pain over the appendix, but slight pressure in the lumbar region caused great pain. This lumbar pain remained localized, and did not radiate along the right ureter. An examination of the urine, made at this time, gave the following findings: sp gr 1015, color, dark brown, turbid, reaction, acid, albumen, trace, sugar, none, casts, none, blood, abundant (20 to 100 red cells to a field). On the basis that the attack might be due to renal colic rather than to appendicitis, we deferred operation. An X-ray picture was taken but it did not show the presence of a stone. A cystoscopic examination was negative. No tubercle bacilli were

found in the urine. This attack lasted two days, and after its subsidence the patient was observed for three weeks. During this period there were two attacks exactly similar to the first one. Exploratory laparotomy was now decided upon, with the idea of examining the appendix first, and if that organ were found to be normal to expose the right kidney. The operation disclosed a very acutely inflamed appendix. The patient was traced for six months after the appendicectomy, and during this time he was hard at work, manifesting no evidence of renal or intraperitoneal disease.

CASE II — A S, 28 years old, Russian, peddler, family and past history negative. Three days before admission to the hospital he had an acute attack of pain limited to the right iliac fossa and right loin, accompanied by fever (101°) and tenderness over the whole right side of the abdomen. There had been no chill, no vomiting, and no other symptoms referable to the gastro-intestinal tract. The disease had been diagnosed by Dr Friedman as appendicitis. When I saw the patient his temperature was 100.6° , his pulse 99, and there was slight tenderness over McBurney's point. The abdominal walls were lax. In the right loin, tenderness was exquisitely marked, and at this site there was distinct bulging, over which deep fluctuation could be made out. At the time of this examination the urine was bright red in color, due to the admixture of a very large quantity of blood. An aspirating needle inserted into the bulging mass in the loin withdrew extremely foul-smelling pus. The result of the aspiration, the severe hæmaturia, the laxness of the abdominal walls, the minimal amount of abdominal tenderness, and the absence of marked gastro-intestinal symptoms, led me to make the diagnosis of perinephritic abscess due to primary renal disease. The patient was too septic at this time to attempt to determine the exact nature of the kidney lesion. The perinephritic abscess was opened and drained, and the patient returned to bed. He never rallied from the operation, dying eighteen hours later. A post-mortem examination disclosed a general diffuse purulent peritonitis, due to a totally gangrenous perforated appendix. The cæcum lay directly anterior to the right kidney, and the appendix was retrocæcal, lying upon the kidney. The entire perinephritic tissue, including the kidney capsule, was gangrenous, and the kidney was so intensely congested that it was a deep

blue-black in color There were numerous infarctions of the kidney cortex

CASE III—I T, 34 years old, seamstress by occupation Family history negative Ten years ago she had a profuse pulmonary hemorrhage and was told by her physician that she had tuberculosis After a prolonged stay in a Northern resort she was pronounced cured Present history dated back four months, the chief complaints being frequent painful urination, and continuous backache, with intercurrent acute attacks corresponding in every detail with the symptoms of renal colic The patient stated that in one of these attacks three months ago she urinated pure blood, but that she never noticed blood in her urine before or after this The day after her visit to the office she had an acute attack in which she experienced pain in the right loin, radiating down the right ureter The pain was so severe that she fainted Physical examination disclosed slight dulness over the apex of the right lung anteriorly, tenderness over the right kidney and along the course of the right ureter, and the presence of a faint trace of albumin and a few red blood-cells in the urine There was an afternoon temperature of 99.5° Tubercle bacilli were never discovered in the urine Ureter catheterization was done by Dr Johnson, with the following result The bladder mucosa was normal, as was also the ureteral openings A ureter catheter readily passed up the left ureter to the kidney The right ureter was blocked at a point about two inches from the bladder wall Even a stylet-armed catheter could not be forced by the obstruction

These findings led to the thought that a ureter stone was causing the obstruction and all the other symptoms already detailed Five X-ray plates made at three different sittings by Dr Carman showed in each instance a clear-cut shadow in the course of the intrapelvic portion of the right ureter Pain was persistent, excruciating, and incessant after the catheterization, and this symptom confirmed us in our belief that a stone had been dislodged from a fairly comfortable resting place

At operation, the ureter was exposed by the iliac extraperitoneal route, from the kidney to the bladder, but no stone was found in it At the site where the X-ray showed a shadow, the ureter was kinked as if pulled upward and inward At the site of kinking there seemed to be a hard nodule resting on the

anterior surface of the ureter, and in order to determine exactly what this nodule was the peritoneum was opened. Through this opening we made out that an inflamed appendix containing a stony hard concretion was adherent to the anterior surface of the ureter. At the site of adhesion the ureter was pulled upward and kinked. Appendicectomy was done, the peritoneum sutured, and the wound in the soft parts closed around a drain. An X-ray picture was taken of the appendix immediately, and this picture gave a distinct shadow of the concretion. The appendix was then opened and found to contain a few drops of pus in its dilated tip, back of which there was a dense fecal concretion that had formed about a small seed with a hard chitinous capsule. (The seed was somewhat larger than the seed of a tomato.) The patient reported six months later that she was perfectly well.

Here then, are three cases, all of them encountered within a short period of time, and all of them characterized by the facts, first, that they were wrongly diagnosed by the operating surgeon, secondly, that pain radiating from the kidney region, and blood in the urine were prominent symptoms, and thirdly, that the lesion was in the appendix. By a strange coincidence this set of three cases establishes a basis for a rational classification of instances of hæmaturia complicating appendicitis. The first case was one in which no direct relationship could be established between the lesion in the appendix and the hæmaturia. Dieulafoy³ asserts that there is an intimate relationship between acute appendicitis and nephritis, and he bases his assertion on the clinical observation that acute nephritis so often accompanies acute lesions of the appendix. The nephritis, which Dieulafoy calls "*Nephrite toxique appendiculaire*," is supposed to be due to irritation of the kidneys by the toxins resulting from the inflammation of the appendix. Dieulafoy states, furthermore, that the severity of the nephritis is in direct proportion to the acuity of the lesion in the appendix. Whether this last statement be true or not, it certainly is a fact, that acute appendicitis often causes an acute nephritis, and there is no reason for not believing that the inflammation of the kidney may result in the presence of red

blood-cells in the urine Dieulafoy, in his paper, makes no mention of hæmaturia, but Hildebrand ⁴ in a paper confirming Dieulafoy's observations, records a case of acute appendicitis complicated by a well-marked hæmaturia In this case, the hæmaturia disappeared after the acute inflammation of the appendix subsided, but reappeared with a second attack of appendicitis, finally disappearing for good, after the appendix was removed Accepting, then, the views of Dieulafoy and Hildebrand, we may assume fairly that in our first case the hæmaturia was due to a toxic nephritis, secondary to appendicitis

In our second case, the bleeding was due to a direct involvement of the kidney, as a result of the proximity of an acutely inflamed and gangrenous appendix, which had infected the perinephric fatty and cellular tissue

In our third case we know that the ureter was kinked by an adherent appendix, but we cannot state positively just what caused the presence of blood in the urine Possibly the kinking of the ureter caused a venous obstruction, and a consequent slight outpouring of blood from the ureteral mucous membrane I can find in the literature only two other cases of appendicitis that caused marked urinary symptoms due to adhesion between the ureter and the appendix These cases are reported by Lancien,⁵ but he makes no mention of hæmaturia as a symptom

Beating our three cases in mind, we see how readily they lend themselves to the following classification (1) Cases of hæmaturia due to the actions of toxins upon the kidneys, (2) cases of hæmaturia due to direct involvement of the kidney, and (3) cases of hæmaturia due to direct involvement of the ureter If, in addition to the three cases reported in this paper, we examine the recorded cases in literature, we find one other source of hæmaturia complicating appendicitis Cases are recorded in which the urinary bladder was perforated by an appendicular abscess, one of the symptoms of the perforation being blood in the urine (Odde and Silhol,⁶ Lancien,⁵ Brun⁷)

A complete classification of the subject therefore would have to be framed as follows

Hæmaturia complicating appendicitis may be due to —

1 General systemic invasion resulting from acute appendicitis, and affecting the kidney indirectly,—so-called toxic nephritis

2 Involvement directly of one or more of the organs of the urinary tract

a Kidney, as in case 2 of this paper

b Ureter, as in case 3 of this paper

c Bladder, as in the cases recorded by Odde and Silhol, Lancien, and Brun

BIBLIOGRAPHY

The recorded cases of blood in the urine of patients suffering with appendicitis are very scanty. There are no papers in English, French or German, that take up the subject by title, but the following papers all have a direct bearing on the subject

¹ Jacobson Surgical Toxic Nephritis, *ANNALS OF SURGERY*, June, 1907

² Lannelongue Importance of Toxicity of the Urine, *Jour Amer Med Assoc*, June 29, 1907, abstract

³ Dieulafoy La Nephrite Toxique Appendiculaire, *Semaine Medicale*, No 42, 1903

⁴ Hildebrandt Ueber complizierende Nephritis bei Perityphlitis, *Mitt aus der Grenz Der Med und Chir*, B 14, 1905

⁵ Lancien Contribution a l'étude des troubles de l'appareil urinaire au cours de l'appendicite, Thesis Paris, 1902

⁶ Odde and Silhol Complications urinaires de l'appendicite *Marseille Med*, vol 41, p 431

⁷ Brun Absces de la cavite de Retzius par Appendicite, *Presse Med Par*, vol 4, p 341

⁸ Johnson *Med Chir Review*, New York, 1837, p 197

⁹ Walther Quoted by Odde and Silhol ⁶

¹⁰ Moldowsky *Ibid*

¹¹ Boucheseiche Contribution a l'étude des modifications urinaires dans l'appendicite, Thesis Paris, 1904

NOTE—Since the completion of this paper, an article has been written by Dr Gray L. Hunner (*Jour Am Med Asso*, Apr 25, 1908) emphasizing the importance of hæmaturia as a complicating factor in appendicitis

VOLKMANN'S ISCHEMIC PARALYSIS *

BY ALFRED S TAYLOR,

OF NEW YORK,

Visiting Surgeon to Randall's Island Hospital, Assistant Instructor in Operative Surgery at the College of Physicians and Surgeons, New York

ISCHEMIC paralysis, first described by Volkmann in 1880-81, is a comparatively rare lesion if one is to judge by the small number of cases in the literature. However, as its importance has been emphasized in the last few years, a rapidly increasing number of cases has been reported. In 1904, Schramm could collect only 27 cases. In 1907, Powers collected 52 cases, to which I am able to add 6 cases from the recent literature and one personal case which will be described later. In the last four years more cases have been reported than in the preceding twenty-four years, which is rather an index of the increasing interest in the subject, than of the greater frequency of the lesion.

In all but two of the 59 cases the forearm was involved (flexor muscles). The other two cases occurred in the flexors of the leg and foot. The great majority of cases occur in children from three to twelve years old. Their vessels are less mature and the circulation of their muscles is more easily disturbed. The underlying cause in all these cases is ischemia (or, better, oxygen-deprivation), which may be induced by direct compression of the vessels and muscles, or by contusion, laceration, thrombosis, or embolism of the vessels. These factors may be more or less combined. At least 80 per cent of the cases reported have followed fractures where splints or plaster bandages have been too firmly applied. The fractures have involved the arm and forearm in about equal numbers, always the lower third of the humerus in the arm, and usually the middle of the bones in the forearm. Complete ischemia,

* Read before the New York Surgical Society, April 8, 1908

persisting for more than six hours, is almost sure to be followed by serious contracture

Pathological Changes —At the time of injury, the circulation distal to the fracture is interfered with by the mechanical displacement of the fragments, and the effusion of blood which is greater than is usually supposed (Hildebrand) The artery may be narrowed, torn across, or thrombotic At a later time the artery may be entirely obliterated for a considerable distance, as in Peterson's case Too tightly applied dressings not only enhance the obstruction to the arterial supply but add the element of direct pressure upon the muscle-substance itself How important a factor this direct pressure may be, is indicated by the formation of areas of pressure-necrosis and abscess in the proximal portion of the flexor muscles and skin of the forearm, where the pressure is greatest, in 60 per cent of Schramm's cases Riedinger believes the direct mechanical pressure upon the muscles is the important factor more often than interference with the arterial supply, since, in his four cases the area of muscle damage was exactly coincident with the pressure-area In either case, if the pressure continues for more than six hours, the muscle substance rapidly degenerates, enters a condition of rigor mortis, and shortens, causing the typical deformity When the pressure is relieved, there is marked effusion from the damaged vessels, and round-celled infiltration of the soft tissues The muscle is more or less replaced by connective tissue according to the severity of the case With the lapse of time the cicatrix becomes harder, shorter and the deformity more fixed

Primarily the nerves may show no change, or may show degeneration as a result of the ischemia and pressure Later, whether primarily involved or not, they may suffer degeneration from the pressure of the contracting cicatrized muscles, and this in turn results in atrophic changes in their muscle-fields In the area of compression the nerves are often nothing but fibrous bands, while above, they are thicker and softer than normal from congestion Sometimes they are nodular from irregular compression

The symptoms, in rapidity of onset and severity, depend upon the degree of ischemia present and its duration. In the severe cases, the symptoms are prompt in appearance and very characteristic. Almost immediately after the application of the tight dressings the patient makes vigorous complaint of pain. If the splint is not promptly removed, the pain increases in severity, marked swelling occurs in the hand and fingers, together with purple discoloration and the formation of skin-blebs. Within twenty-four hours the hand assumes the claw-shape resulting from contracture of the damaged flexor muscles, and if the dressing be not then removed, necrosis of the skin and flexor muscles is very apt to occur a short distance below the elbow (60 per cent of Schramm's cases).

On removal of the splint, the flexor muscles are very hard and board-like to the touch, and the extremity is in characteristic position. The elbow is slightly flexed, the forearm pronated, the wrist slightly flexed, and the fingers strongly flexed in the claw-hand position. When the wrist is extended as much as possible, the fingers cannot be extended by any degree of force short of that sufficient to break the bones or rupture the tendons. When the wrist is fully flexed, the fingers may readily be extended by passive motion, although in bad cases this extension may not be complete. When the wrist is extended the fingers automatically flex and cannot be prevented from doing so by any degree of resistance. All attempts at extension, in whatever position, cause the cicatrized muscles to spring into prominence between the internal epicondyle and the front of the wrist. In the severest cases the contracture is sufficient to drive the fingernails into the palm of the hand.

When the nerves (usually median and ulnar) are primarily damaged by the ischemia, there is loss of sensation and paralysis of the muscle-field, which is partial or complete, according to the degree of nerve injury. When the nerves are not primarily involved they are very apt to undergo degeneration from compression by the cicatrization of the muscles. In either case, when nerve damage is present, there will develop trophic changes (blue, cold, glossy, thin skin), and mus-

cular atrophy in the nerve-field, in addition to loss of sensation and paralysis

In less severe cases the symptoms develop more slowly

Diagnosis —When, after the application of firm dressings to a fractured extremity, there appear rapidly and simultaneously, pain, swelling, discoloration, flexion-contracture of the fingers and wrist, with loss of power to extend them either actively or passively, ischemic paralysis is present. Paralysis due to nerve injury is very different. Here the muscles are flaccid, permit passive motion through the full range, and contracture when it does occur is late in appearing and slow in development. The characteristic features then, of ischemic paralysis, are the rapid and simultaneous onset of loss of function, flexor-contracture, and rigid resistance to passive extension.

It is important, both for purposes of prognosis and treatment, to determine whether the nerves have been involved either early or late in the process. If the muscle responds, even though very faintly, to both faradic and galvanic current, there is no nerve injury. If the muscle responds to galvanic but not to faradic current, there is nerve injury. If the muscle responds to neither galvanic nor faradic current, there is complete muscle injury, nerve injury not determined. In this last contingency help may be derived from the examination of the muscles of the hand (interossei, lumbricales, thenar and hypothenar groups) which are very seldom or never involved in the ischemic lesion. According to the reactions of these muscles, it can be determined whether or not nerve impulses pass through the damaged area above, and therefore whether the nerves themselves are damaged.

Prognosis —The prognosis varies not only with the degree of muscle and nerve damage, but depends decidedly upon the promptness and energy of treatment. In general the prognosis is unfavorable. Where the muscle has been entirely cicatrized there is no hope whatever. When only a small portion of muscle has been involved, proper treatment may

result in complete or nearly complete cure. Between these two extremes there are many degrees of recovery.

Treatment—Bearing upon the subject of treatment are certain important facts derived from experimental research. Lapinsky caused ischemia in dogs' legs by tying the chief arteries. If the collateral circulation was allowed to develop, power slowly returned in the paralyzed muscles without inflammatory reaction. When, however, blood was allowed to return rapidly into the vessels weakened by prolonged absence of oxygen, effusion, swelling, and interference with the return of power in the muscles occurred. Leser caused ischemia in dogs' legs by tight splints. When the ischemic contracture had developed, if the splint was removed and the dog allowed to run free, the muscles soon returned to normal condition. If the limb was immediately re-immobilized, whether with a tight or loose dressing, a permanent contracture developed. This means that activity of the muscle substance so improves its circulation and nutrition as to prevent the degenerative changes which follow continued immobilization.

Treatment, based upon the sequence of pathological changes and the results of experimental work, must be early and vigorous. The longer ischemic paralysis has existed, the more difficult it is to cure, in fact, other things being equal, the success of treatment varies almost inversely as the time elapsed since injury. The cicatrization of the muscles, which is the essential feature of the condition, becomes more complete the longer the contracture exists. Prophylaxis is most important. No tight primary dressing nor any form of treatment which would cause circulatory obstruction should be applied to any fracture, especially in children when it involves the region of the elbow-joint, for this combination of circumstances is present in 96 per cent of the reported cases. In every form of dressing allowance must be made for post-traumatic swelling. Frequent inspection or report, at intervals of not more than four hours, should be insisted upon for the first twenty-four hours. The dressing should be promptly removed if the patient complains of increasing pain, or if

swelling or discoloration appear with or without beginning flexor-contracture

In every case reported in the literature, the removal of the primary dressing has been followed by the application of another, which, while looser, has continued the immobilization of the muscles. In the light of Leser's experiments this is faulty treatment. Not only should the primary dressing be removed but massage, electricity, active motion if possible, vigorous passive motion, under an anesthetic if necessary, should be used to restore the circulation in the damaged muscles. During these procedures proper support should be given to the fracture by an assistant, and afterwards the extremity should be lightly bandaged to prevent too much effusion into the damaged muscles. These measures should be repeated every few hours until the muscles are in good condition again, when attention may once more be directed to the fracture itself. Even if this treatment should result in mal-union, non-union, or pseudarthrosis, either of these conditions is much less troublesome and more easily corrected than an ischemic contracture.

After the condition is once present, there is a choice between non-operative and operative treatment. Non-operative treatment consists in baths, massage, electricity, and passive motion. Some authors advise repeated strenuous extensions of the wrist and fingers, under an anesthetic if necessary.

Martin (C) reported a case in which continuous slow elastic traction gave a most satisfactory result in a comparatively short time.

Sayre (R) recently showed a case (see bibliography) where a very good result was obtained after using mechanical extension for six months. In both these cases the contracture did not appear for some six or seven weeks after the injury and it would seem probable that not so much of the muscle substance was damaged as in the cases with more rapid onset. Therefore a favorable result might be expected.

In severe cases, where the circulation is more seriously

damaged, these mechanical appliances involve a degree of risk, for pressure sores occur upon slight provocation

Non-operative treatment is tedious, difficult, and the majority of results reported are not satisfactory. It gives no relief to compressed nerves.

Operative treatment gives quicker and more complete results according to the statistics of the published cases. In many of the operative cases palliative treatment had been tried for long periods of time without result.

There are two operative procedures each of which has its advocates. Tendon-lengthening, in which the flexor tendons are elongated sufficiently to permit complete simultaneous extension of the wrist and fingers. Advantages—no shortening of the forearm, no chance of mal-union, non-union, or pseudarthrosis. Disadvantages—operation is tedious, tendons may become mixed, adherent to each other and to the skin cicatrix, thus limiting mobility, the nerves may be injured or divided and sutured by mistake to tendon, as has happened in some of the reported cases.

To minimize adhesions to the skin some operators make a U-shaped flap with the convexity upward.

Resection of both bones of the forearm was first advised by Henle in 1896. Enough (1.5 to 2 cm) is removed to permit complete extension of the wrist and fingers simultaneously (See appended case-history). Advantages—operation is short, avoids adhesions of tendons to each other and to skin, avoids damage to nerves. Disadvantages—forearm is shortened, there is possibility of mal-union, non-union, or pseudarthrosis (Non-union has been reported once).

Both operations have given good results and both ultimately act in the same way by eliminating the deformity, increasing the range of passive motion, relieving the extensor muscles from overstretching, and placing the flexor muscles under conditions most favorable to regeneration. The ultimate result depends on the amount of muscle regeneration in the cicatricial area. The greatest stimulus to regeneration comes from voluntary contraction of such muscle as is left.

Both operations, by relieving the tension, not only favor such voluntary contraction, but greatly increase the circulation and nutrition of the muscle

While tendoplasty has its warm advocates, most operations are turning to resection of both bones of the forearm because it reaches the same result by a shorter, simpler method. The danger of non-union is small, and the slight shortening causes no functional disturbance

In every case presenting signs of nerve compression, whether primarily or secondarily, the nerves (median and ulnar) should be released. Freeman, who especially emphasizes the frequency and importance of nerve lesions in these cases, advocates transferring the nerves to a subcutaneous position, or excising some of the cicatrized muscle to allow more space for the nerve in its natural position

When the flexor muscles have been completely changed to fibrous tissue, of course no procedure can cause regeneration. Since, however, it cannot be determined clinically when the muscle is entirely gone, no case should be denied the benefit of the doubt and refused the operation

Even in cases which give no hope of the return of motor power, much can be done to relieve trophic and sensory disturbances by neurolysis

In the report of the two cases involving the foot and leg, subcutaneous tenotomy of the flexor tendons relieved the talipes equinus and gave a useful leg, although flexor power was entirely absent

In two cases in the forearm, tenotomy of the flexors was done at the wrist, with the result of making a better looking but perfectly useless extremity

As soon as the tendons or bones, according to the operation done, have firmly united, baths, massage, electricity, and passive motion should be employed vigorously and systematically until function has been restored to the muscles. Active use of the extremity should be encouraged at the earliest moment

The object of after-treatment is to cause absorption of

cicatricial tissue and regeneration of muscle tissue. In the case reported below, progress seemed to be materially aided by preceding the bath and massage by congestive hyperemia for one to two hours, and combining theunction of mercurial ointment into the cicatricial area with the massage.

Hope must not be given up even if no apparent progress is made for months, as these cases are invariably tedious, especially when the nerves have been involved.

CASE HISTORY—Louis K. fell and broke the lower end of the right humerus on May 5, 1906. He was 4 years, 9 months old. One hour after the injury a plaster splint was applied. The next day the extremity was very painful and the hand was swollen, cyanotic, and covered with large blebs. The pains gradually subsided. On the seventh day, when the splint was first removed, there was an abscess involving the skin and flexor muscles just below the elbow, and a well marked, rigid, flexor-contraction of the wrist and fingers. The abscess was treated and the splint replaced. After four weeks the splint was discarded and the abscess was still discharging.

For eight months massage, electricity, passive motion, and vibration were tried with absolutely no benefit. Then, January, 1907, thinking the trouble was due to inclusion of the musculo-spiral nerve in the callus, an incision was made over the nerve at the outer side of the elbow. The nerve was not involved. The previous treatment was continued until June, 1907 (13 months), when he was referred to me by Dr. S. A. Twinch, who was not, however, responsible for the treatment of the original fracture.

Physical Examination—A boy, slender, blonde, and in good general condition. The right arm is freely movable in all directions at the shoulder. There is moderate convex deformity above the external condyle of the humerus, result of the old fracture, resembling gunstock deformity. There is a linear scar over the outer aspect of the elbow from the incision over the musculo-spiral nerve. Just below the elbow on the flexor surface is the scar of the old abscess, 4 x 2 cm. The hand is cold, blue, with thin, shiny skin, and with trophic disturbances of the finger-tips, as indicated by thickened, corrugated nails, and red, shiny skin,

showing a tendency to ulcerate, especially on the tips of the index and middle fingers. The forearm, wrist, and hand are rigid, with the wrist flexed about 20° , the metacarpo-phalangeal joints slightly extended and the remaining finger joints about half flexed. It closely resembles "main-en-griffe." An unyielding, rigid band runs along the flexor aspect of the forearm from the internal condyle of the humerus to the wrist, which becomes more prominent on attempting to extend the wrist and fingers, and evidently prevents such extension. This same band prevents full extension of the elbow. All the flexors of the fingers are apparently involved in this cicatricial mass.

Active Motion—Absent in the wrist joint. Very slight power of extension at the metacarpo-phalangeal joints. The extensor muscles contract definitely but cannot overcome the flexor contracture. The musculo-spiral nerve is therefore undamaged. The fingers spring back to their positions instead of being drawn back by flexor contraction. The fingers cannot be flexed.

Passive Motion—The wrist can be fully flexed and, when held in this position, the fingers can be fully extended on the hand. When the wrist is brought back to the limit of its extension, the fingers, *pari passu*, resume their flexed position and no amount of force can prevent them from doing so. When the wrist is held at its limit of extension, the fingers can be fully flexed but can be extended only very slightly beyond the position they naturally assume when left alone.

There is atrophy of the interossei, thenar, and hypothenar muscles, and this, together with the trophic changes in the fingers, indicates that both the ulnar and median nerves are damaged.

Operation July 6, 1907. Ether. A 10 cm longitudinal incision was made over the middle of the forearm just below the elbow. The flexors, superficial and deep, seemed to be entirely fibrous. An incision was made through them to expose the median nerve. They were mostly fibrous tissue with a few muscle fibres scattered here and there. There was but little bleeding. The median nerve, beginning where it passes between the two heads of the pronator radii teres, was compressed, thin, and white for a distance of 5 cm downward. Above this area the nerve was much thicker and more congested than normal, while below, it was about normal in size and appearance. The

nerve was freed and wrapped in Cargile membrane. The ulnar nerve was compressed but not so much as the median. It was treated in the same way. The muscles were lightly sutured with catgut and the skin closed with silk.

By the subperiosteal method, 2 cm. of each bone of the forearm was removed, in the ulna 5 cm., and in the radius 7 cm. above its lower end. Different levels were chosen to avoid possible difficulty from cross union, and also to make it easier to hold the bones in position. The bones bled freely.

With the bones thus shortened the wrist and fingers could be extended simultaneously and fully. The marrow canals of the bones were too small to permit the use of Elsberg aluminum tubes inside, so tubes just large enough to receive the bone-ends were fitted in subperiosteally, the bones slipped into them and the periosteum sutured over them with catgut. The skin was closed with silk without drainage. The extremity was put up on an anterior splint with the fingers and wrist fully extended. All the wounds healed by primary union.

Post-operative History—August 24, seven weeks after operation, the bones are firmly united. There is a fusiform swelling over the aluminum tube on each bone. Splint was discarded. The wrist and fingers can be fully and simultaneously extended by passive motion.

October 30 (3 months, 24 days). There is some return of the flexion contracture of the wrist and fingers. Marked improvement in the warmth, color, and nutrition of the hand. The thumb can be adducted and slightly flexed voluntarily. The fingers can be slightly moved by the extensors, but flexed only by the interossei so that the distal joints extend while the metacarpophalangeal joints flex. Fusiform swellings still persist at the points of resection.

February 3, 1908 (7 months). The contracture at the wrist and fingers has slightly increased. The interossei and thenar muscles are distinctly less atrophied and the thumb can be slightly flexed and well adducted so as to firmly grasp things between it and the side of the index finger. The little finger can be slightly flexed. The index, ring and middle fingers can be flexed only at the metacarpo-phalangeal joints, by the interossei muscles. All the digits can be slightly extended voluntarily. The elbow can

FIG 1



X ray picture taken nine months after operation for ischemic paralysis 1 Site of resection of the radius showing the aluminum tube still in the callus 2 Site of resection of the ulna, showing the tube more distinctly and a larger callus The perfect alignment of both bones obtained by using tubes is clearly shown

be extended a little more than before operation. The cicatricial mass seems to have diminished a little in size and rigidity. The fusiform swelling over the radius has entirely disappeared, over the ulna, the swelling is much larger as the result of a fall a few days ago (Fig 1).

March 6, 1908 (8 months). The swelling on the ulna is much diminished. The hand is normal in color, temperature, and trophic appearance of the skin, and the interossei, thenar and hypothenar muscles are evidently returning to their normal size. Voluntary extension of the fingers is stronger. There is slight flexion of the fingers apparently by the long flexors.

In this case the history was characteristic and the onset was sudden, as indicated by the appearance, within twenty-four hours, of swelling, cyanosis, and skin-blebs of the hand. Abscess of the flexor muscles indicated a severe case. Non-operative treatment was carried out vigorously and systematically for thirteen months with absolutely no benefit. Operative treatment was then tried as offering the only hope left, although this was small. After eight months, there is slight improvement in mobility of the wrist and fingers, the appearance of very slight power to flex the tips of the fingers, marked improvement in power and movement of the thumb, development of the interossei and thenar muscles, and the return of normal trophic conditions to the hand and fingers.

The greatest improvement has occurred in the last two months, so that there is much to hope from the future of the case.

Summary—Ischemic paralysis is essentially a myositis resulting from prolonged absence from the muscle of oxygenated blood. Muscle substance is replaced by fibrous tissue in proportion to the severity of the case, with a corresponding degree and rigidity of contracture.

The nerves are frequently involved, either primarily from the ischemia and pressure, or secondarily from compression by the cicatricial mass. This form of paralysis occurs, nearly always, in the forearm after too tight dressings have been

applied to fractures near the elbow The great majority of cases occur in children from three to twelve years old

Diagnostic Symptoms—Early onset of severe pain and swelling, simultaneous appearance of rigid contracture with the paralysis of the muscles, causing the characteristic “claw-hand” The simultaneous appearance of the contracture with the paralysis differentiates these cases from palsies due purely to nerve lesions

Severe cases may result from six hours of tight compression

Evidence of damage to nerves should always be sought

Treatment—Prophylaxis is most important No tight dressings should be used on any fractures, especially when they are near the elbow-joint in children In all dressings allowance must be made for traumatic reactionary swelling Frequent inspections of dressings must be made for the first two days after injury

When the lesion occurs, dressings must be removed, the fracture neglected for the time being, and attention paid solely to the return of muscle nutrition and function

Non-operative treatment consists in the use of massage, electricity, vigorous passive motion, etc (so-called physical therapeutics)

Operative Treatment—Lengthening of the tendons of the shortened muscles sufficiently to permit simultaneous extension of the wrist and fingers

Resection of both bones of the forearm is a simpler and probably a better operation Enough is removed to permit full extension of the wrist and fingers

Either operation relieves the excessive tension and favors muscle regeneration

In all cases damaged nerves should be properly cared for

After-treatment consists of physical therapeutics and must be vigorously and systematically applied

Prognosis is on the whole unfavorable, complete cure is rare, improvement often comes only after months or years of steady work

Results are better the earlier and more vigorous the treatment *

BIBLIOGRAPHY

- Hoyneck (P) Ein Fall von ischämischer Lahmung nach Arterienverschluss mit anatomischen Untersuchungen der Nerven und Muskeln Bonn, 1902
- Kaempfe (E) Beiträge zur Casuistik der ischämischen Muskellähmungen und Contracturen Berlin, 1897
- Kob (B) Ueber die Behandlung der ischämischen Lahmungen des Vorderarms durch Resektion der Vorderarmknochen Königsberg 1 Pr, 1905
- Willmann (L) Ein Beitrag zur Therapie der ischämischen Kontrakturen und Lahmungen Giessen, 1905
- Bernays (A C) On ischemic contracture of muscles Boston Med & Surg Jour, 1900, cxlii, 539-542
- Cheminisse (L) La contracture ischémique des membres Semaine Med, 1906
- Edington (G H) Tendon-lengthening in a case of Volkmann's ischemic paralysis Glasgow M J, 1900, liv, 344-350
- Herdelberg (M) Zur Pathologie der quergestreiften Muskel Arch f exper Path u Pharmacol Leipz, 1877-8, viii, 335-354
- Hildebrand (O) Ischämische Muskellähmung Deutsche Med Wchnschr, 1905, xxxi, 1577
- Lapinsky (M) Ueber acute ischämische Lahmung, nebst Bemerkungen über die Veränderungen der Nerven bei acuter Ischämie Deutsch Zeitsch f Nervenhe Leipz, 1900, xvii, 323-350
- Leser (E) Untersuchungen über ischämische Muskellähmungen und Muskelcontracturen Samml klin vortrag, Leip, 1884, 249
- Martin (C) Deux cas de paralysie ischémique de Volkmann traités par les tractions lentes et continues Assoc Franc de chir Proc verb Par, 1903, xvi, 934-942
- Reidinger (J) Ueber sogenannte ischämische Lahmungen und Kontrakturen Sitzungsber d phys-med Gesellsch zu Würzb, 1902, 33-35
- Schramm (H) Beitrag zur Lehre von der sogenannten ischämischen Paralyse und Muskelkontraktur Wien med Wchnschr, 1904, liv, 1253, 1326
- Volkmann Die ischämischen Muskellähmungen und Kontrakturen Centrbl f Chir, Leipz, 1881, viii, 801-803
- Rowlands (R P) A case of Volkmann's Contracture treated by shortening the radius and ulna Lancet, London, 1905, ii, 1168-71
- Barnard (H L) Two cases of ischemic paralysis in children Trans Med Soc, London, 1900-1, xiv, 294

*It was brought out in the discussion by Dr Erdmann at the New York Surgical Society that the gradually returning contracture of the wrist and fingers was due rather to the growth of the bones of the forearm than to further contracture of the cicatricial mass of muscles

- Kraske (P) *Centralbl f Chir*, No 12, 1879
- Schloffer *Schussverletzung des Thorax ischämische Lahmung des Vorderarms* *Wien klin Wochenschr*, Jan 3, 1901, 24
- Powers (C A) *The ischemic paralysis and contracture of Volkmann* *Jour A M A*, Chicago, 1907, *xviii*, 759-765 Tabulates 52 cases
- Freeman (L) *The desirability of early operations upon the nerves in ischemic paralysis* *Surgery, Gynecology and Obstetrics*, July, 1907
- Reports improvement in three cases from neurolysis
- Case 1—Girl, 10 years old, fracture of both bones of forearm, almost perfect result
- Case 2—Boy, 19 years old, injury of fleshy part of forearm without fracture, improvement
- Case 3—Boy, 16 years old, fracture of olecranon, observed only for one month, but there was improvement in sensation
- Huntington (T W) *Ischemic paralysis and contracture* *California State Med Jour*, 1907, *v*, 160-163 One case, fracture near elbow, resection of both bones, improvement
- Lilienthal (H) *Verbal communication, child about 4 years old, fracture near elbow, resection of both bones of forearm, marked improvement.* Case presented before the New York Surgical Society, Dec 11, 1907
- Sayre (R.) Case presented before the Pediatric Section of the New York Academy of Medicine, March 12, 1908 Girl, 16 years old, fractured both bones of the forearm in 1906, splints for four weeks, contracture well developed at seven weeks, massage and electricity for many months without any effect In Sept, 1907, when the hand still showed well-marked "main-en-griffe," Sayre began continuous traction and extension by apparatus, with massage and passive motion at frequent intervals After six months the wrist and fingers can be extended simultaneously, and the thumb can be apposed to most of the fingers

RECURRENT DISLOCATION OF THE ULNAR NERVE.

REPORT OF A SECOND CASE CURED BY OPERATION

BY FARRAR COBB, M D,

OF BOSTON, MASS.,

Assistant Visiting Surgeon to the Massachusetts General Hospital

IN the ANNALS OF SURGERY for November, 1903,^{*} I reported a case of recurrent dislocation of the ulnar nerve cured by operation together with a summary of all operations reported up to that time, fifteen in number. The rarity of this condition and the small number of cases operated upon call for a report of every case. I therefore wish to give the history of a second successful operation and in addition to present a brief review of what has been written on this subject and of the cases operated on since my last paper was published.

The ulnar nerve rarely dislocates forward of the condyle of the humerus, whereas subluxation to the tip of the condyle is not infrequent. About 3 out of 200 cases will show dislocation of the nerve, but the cases in which this dislocation causes painful and disabling symptoms are much rarer. Subluxation almost never causes pain. I have been interested in this subject and have been on the lookout for such cases for the past nine years, during which time I have been on duty at least eight months of each year in a large clinic at the Massachusetts General Hospital. These two cases,—the one previously reported and the one reported below,—are the only ones which have come under my observation, and so far as can be discovered are the only ones in the records of this hospital.

^{*} Report of a case of recurrent dislocation of the ulnar nerve cured by operation. With summary of previously reported cases.

The recurring dislocation of the nerve on flexion of the elbow may be a congenital or habitual condition which does not lead to annoying symptoms. In these idiopathic or non-traumatic cases the dislocation is seldom accompanied by sufficient symptoms to demand operation. If symptoms do appear they yield to palliative treatment in most instances. In the few cases operated upon only two have been the congenital or habitual forms, in all the other operated cases the symptoms have resulted from trauma. The kind and degree of trauma to the region of the elbow causing the lesion are various. Direct violence, such as contusion and hæmatoma of the soft parts, has been followed by recurrent dislocation, indirect violence, such as exercising on a parallel bar or throwing a snow ball, has been sufficient to tear up the fibrous structures normally tying down the nerve and permit of the abnormal mobility. Diffuse suppuration around the elbow also has been followed by dislocation.

The majority of the cases operated upon have followed more or less severe direct violence either from blows or falls. My first case struck the inner side of the left elbow violently against a post, without, however, any bony fracture, about a month before symptoms due to dislocation of the nerve appeared, my second case, reported below, followed a septic wound at the inner side of the elbow and an incision for drainage of a large collection of pus. A case reported by Croft was also that of a young woman with septic infection in the region of the elbow following an injury.

The characteristic symptoms are severe darting pain at the region of the elbow into the distribution of the ulnar nerve in the hand. Numbness and tingling in the inner fingers of the hand may be present all the time, but flexion of the forearm causes a severe shooting pain from the elbow into the fingers. In both my cases flexion and extension of the forearm caused pain referred to the internal condyle of the humerus and inner side of the forearm and the two inner fingers of the hand. There was no loss of sensation in the region supplied by the ulnar nerve, the strength of the hand

was good and there was no muscular atrophy. There was entire disability for any form of work necessitating the use of the affected arm.

It is the accepted theory of nearly all who have reported cases of this condition that the darting pain along the course of the nerve is caused by the trauma of the oft-recurring excursions or jumps over the tip of the internal condyle, and that in a comparatively short period of time pathological changes in the nerve and its sheath take place. In most of the cases operated upon the nerve was found to be distinctly enlarged and fusiform in shape. The only case in which a microscopic examination of the nerve structure has been made was in the case of Andrae, which was summarized in my previous paper. Acting on the theory that the dislocation was due to the excessive length of the nerve caused by stretching Andrae excised the fusiform enlargement and sutured the ends of the resected nerve together. Examination of the excised piece showed a typical neurofibroma with marked thickening of the nerve sheath.

For a complete review of the subject as well as abstracts of cases reported previous to 1903 the reader is referred to my previous paper, also to the articles by Poncet, Haim, Schwartz, Rosenbach, Jopson, and Cotton, references for which are given in the bibliography at the end of this paper.

My first case was that of a man fifty-two years old. He was operated upon in 1900. Dislocation followed a blow as stated above. He had been disabled for six months. At operation the groove back of the internal condyle, in which normally the nerve should rest, was filled by muscle-fibres,—evidently a portion of the triceps. The nerve could be easily moved about between the points where it emerged from the intermuscular septum and passed between the two heads of the flexor carpi ulnaris. It was fusiform in shape and as large as a lead pencil in its thickest portion. There was no strong band of fascia passing over the nerve, the so-called arcuate ligament. It was evident that at the original injury the fibrous and muscular structures back of the condyle had been torn

on ruptured and in the process of repair the bony groove had been filled up with muscle-fibres

The groove was cleared and the nerve replaced and a flap from the triceps fascia sutured over it to the fascia covering the flexor muscles. I have heard from him within a few weeks, eight years after the operation. He has remained absolutely free from any of the symptoms and has been able to engage in his occupation as lumberman.

REPORT OF THE SECOND CASE—M. H., a young Irish-American woman, twenty-two years old, single, domestic servant by occupation, was first seen by me early in June, 1906, in the out-patient department of the Massachusetts General Hospital. She was kept under palliative treatment for two months before it was decided to operate. Her previous history was as follows. In 1904 she had been an inmate of the hospital because of accidentally swallowing a large safety-pin. This was removed successfully by Dr. Algernon Coolidge. One year before she came under my notice she had received a small lacerated wound at the inner side of the right elbow, which became infected and suppurated extensively for weeks. She was treated for this in the out-patient department. Soon after the infected wound healed she began to be troubled by numbness and pricking sensations in the fourth and fifth fingers of the right hand and shooting pain along the inner side of the right forearm starting from the elbow and continuing into the fingers of the hand. These symptoms at first did not bother her to any extent when she kept the arm still, but any motion involving flexion of the forearm at the elbow started up the severe pain. She had had an operation for the relief of these painful symptoms, which operation, so far as could be found out, consisted of dissecting out the scar of the old incisions for drainage, presumably on the theory that the symptoms were due to pressure upon the ulnar nerve. No relief was obtained from this treatment.

It was evident that the attendants in the clinic considered her complaints of pain as feigned, and I was informed that she was an old hysterical case and everything had been done that could be done for her symptoms, which were doubtless imaginary.

Examination showed a well-developed and nourished young

woman not markedly neurotic in appearance or conduct. The pupils were equal and reacted normally. There was nothing abnormal found in the heart, lungs or abdomen. There was a slight enlargement of the thyroid gland. Knee-jerks were normal. The right elbow was held in semi-flexion. Motions of the joint were possible, both flexion and extension, but caused complaint of severe pain at the inside of the elbow darting along the inside of the forearm and into the hand. On the inside of the arm over the course of the ulnar nerve was a wide dense scar about four inches long. The lower end of the scar was about two centimetres above the internal condyle of the humerus. The scar was readily movable over the underlying tissues. The ulnar nerve could be felt, with the arm in extension, in its groove back of the condyle, upon flexion it dislocates well forward of the condyle. The nerve was evidently enlarged and could be felt to the upper and outer side of the scar on the arm and could be traced for at least an inch and a half further than in normal arms. Pressure upon the nerve back of the condyle, and also where it was exposed under the skin upon the arm, caused extreme pain at the site of pressure and referred pain into the fingers.

There was no disturbance in sensation in the ulnar distribution in the hand nor was there evident loss of strength in the hand or muscular atrophy. Because of the suspicion of neurasthenia in the case, although the symptoms and signs of nerve dislocation were sufficiently plain, I was persuaded to try palliative treatment for a longer time than usual. The arm was put on an internal right-angled splint for three weeks. While it rested on the splint there was no acute pain, but some prickling sensations and numbness in the fingers persisted. At the end of three weeks upon removing the splint there was just as much pain, both local and referred, upon pressure and attempts to use the arm caused severe pain. It was impossible for her to use a broom in sweeping or to do any household work which called for flexion of the forearm at the elbow. A second period of rest for three weeks made no change in the conditions. At the end of two months' palliative treatment I became convinced that this was a case of actual disability from recurrent dislocation of the nerve, and also that it was a case in which, because of extensive suppuration and previous operation, the nerve had even more freedom than is found usually. The movement of the nerve in the arm, as the forearm was flexed, was marked. Either by the suppuration or previous

operation the nerve had been freed from its normal place under the aponeurosis of the triceps and was subcutaneous for an abnormal distance. Accordingly I operated upon the patient on the 15th of August, 1906.

The old scar was dissected out and it was found that the nerve was exposed for a distance of about two inches above the groove in the condyle and at the point where it entered the aponeurosis over the triceps muscle it was bound down firmly by scar-tissue. Between this point and the groove it was enlarged, reddened and freely movable. The fibrous tissues normally pinning the nerve down into the groove behind the condyle were not defined, a condition which meant that with every flexion of the forearm the nerve was displaced forward over the condyle and also pulled upon at an acute angle where it emerged from the intermuscular septum.

The nerve was buried as nearly as possible in its normal position by making a new fibromuscular canal, suturing the nerve under the fibres of the triceps muscle and also turning over a flap from the aponeurosis of the triceps and suturing it to the fascia over the flexor group. The wound was closed without drainage and the arm put up on an internal right-angled splint. At no time after the operation was there complaint of pain. The splint was removed at the end of three weeks and active and passive motion begun without bad result.

I saw the patient over a year after the operation. She has been at all times free from pain and disability, has married and is able to do her own housework.

Emil Hamm (Ueber Luxation der Ulnaris, *Deutsche Zeitschrift für Chirurgie*, Leipzig, 1904, lxxiv, 96) reported two cases, one operated on by Lotheisen and one case of Von Hacker personally communicated to Lotheisen, a case operated on at the Innsbrucker clinic. Hamm in common with certain other German writers discusses at some length the question of a predisposing cause in the non-traumatic cases. He thinks that the dislocation is never congenital and that a predisposition exists. He, as well as Cohn, advances a new theory which is worth mentioning, although it is hard to attach much importance to it as the cause of the dislocation. He places great

stress on the carrying angle at the elbow, that is, the angle which the forearm makes with the humerus in extension, the *cubitus valgus*, and he thinks it has been proved by a study of many patients that this angle is less in those cases in which the ulnar nerve dislocates. He found in men with normal ulnar nerves that this angle was from 170 to 178 degrees, in women 165 to 175. In the cases in which the subluxation or dislocation of the nerve was present the angle was about 5 degrees less.

The case of VON HACKER is of special interest because of the dislocation of the nerve caused by tuberculosis of the internal condyle. The progress of the disease pushed the nerve forward out of its normal position permitting recurrent dislocation with the typical pain and disability. After dissection of the epitrochlear glands and removal of some diseased bone, the nerve was sutured under a bridge of fascia, with an excellent result so far as the relief of the pain was concerned. No other details of this case are given.

LOTHEISEN's case was one of traumatic dislocation of the *right ulnar nerve* following a blow on the elbow. Operation and recovery. Two years after, operation on the *left nerve* for the same condition. School boy, sixteen years old. No previous trouble in the region of either elbow-joint. Five days before fell, striking on right elbow. Immediately felt severe pain in the elbow and darting pains into the two inner fingers of the right hand. The painful symptoms persisted.

Examination. Normal in every way except in regard to right elbow. The ulnar nerve could be felt as a distinct cord forward and inside of the epicondyle, and pressure on this cord caused severe pain at the elbow and into both inner fingers of the right hand. Upon extension of the forearm the nerve returned to its normal situation. It was noted that the left nerve was somewhat freely movable,—that is to say, there was subluxation. X-ray photographs showed that on both sides the epicondyles were normal and even larger than usual. On both sides there was a marked *cubitus valgus*. The measurement of the carrying angle was 165 degrees.

Operation December 15, 1902. Ethyl chloride anæsthesia. A straight incision over the internal condyle. The nerve appeared normal. It was placed in its groove and a flap of fascia sutured by four silk stitches to the periosteum and edge of the bone,—how is not stated. Skin wound closed without drainage. Arm put up on a splint in extension. After ten days some careful passive motion of the joint, and after fourteen days the arm placed upon a right-angled splint. At the end of three weeks the patient left the hospital without pain. Seven weeks after the operation he was well. (Note the early date at which motion of the elbow was attempted.)

A second operation was done by Lotheisen on this same patient on the other elbow July 14, 1904, about two years after the first injury. While at work suddenly felt a sharp pain in the left elbow and left hand exactly similar to what he had had on the right. By self-examination he noted that the nerve dislocated on each flexion of the forearm. Examination discovered typical dislocation as at the other elbow. A similar operation was done save that the flap of fascia was sutured over the nerve to the edge of the triceps muscle. No after-treatment or result is given, except that on flexion the nerve remained fixed in its normal position.

Rosenbach (*Ueber die Luxation des Ulnarnerven, Deutsche Zeitschrift für Chirurgie*, Leipzig, 1906, lxxxv, 300) from the polyclinic in Gottingen reported a successful operated case and gave a concise review of the subject. In regard to the frequency of complete dislocation he gives the observation of the following men. Raymonenq found no case in 300 persons, Kissinger, 1 case in 200, Haim, no case in 350, and Momberg found 23 cases in 116, all in soldiers. Subluxation of the nerve is not infrequent. Kissinger found this in about one-third of the cases.

In my previous paper I stated that in a series of 150 large and well-developed men I found only 1 case of complete dislocation, but that in over one-third of the cases subluxation was present. These subluxations are not infrequently bilateral and almost never cause painful symptoms. Almost all the German and French writers give a good deal of space to the reasons for complete dislocation of the nerve. The practical points are that there must be some predisposing reason for the dislocation in those cases in which traumatic causes can be eliminated. The connective-tissue fibres from the aponeurosis, the so-called arcuate ligament which binds the nerve down in its groove may be weaker and looser in some persons than in others. This may be a congenital defect or due to conditions of ill health or emaciation. The triceps muscle may be larger than usual and take its insertion lower down so that on flexion of the forearm there is more of the bulging of the muscle tending to push the ulnar nerve out of its place. Again the condyle of the humerus may be smaller and less prominent in certain individuals. Fortunately in all but two or three of the non-traumatic cases of complete dislocation no

operation has been necessary and in those cases in which temporary painful symptoms have been present these have yielded readily to palliative treatment. The serious cases, those demanding operation, are usually the ones in which some definite trauma is the cause, either a blow or some violent motion of the elbow-joint.

Report of ROSENBACH'S Case—A strong woman, eighteen years old, after exercising on a horizontal bar noticed that she could not move her right arm at the elbow without great pain. Applied ice and iodine, and had massage. Wore plaster of Paris bandage for two weeks. On examination complete dislocation of the ulnar nerve was found, with characteristic pain.

Operation seven weeks after the first symptoms discovered that the nerve was enlarged and reddened. The nerve was fixed in its groove by the following method. The groove in the bone was deepened by a gouge before the nerve was replaced. After this a flap of fascia from the triceps was sutured over the nerve to the fascia over the insertion of the flexor group. His reason for gouging out the groove was that he was afraid it would require too great force to hold the nerve in place. No details of the after-treatment are given. The operation cured the patient.

HOLM, A (Et Tilfaelde af Luxatio traumatica nervi ulnaris, Hosp Tid, Kbenh, 1906, 4 R. xiv, 461-468), reported a case operated on in Poulsen's clinic in Copenhagen, November 28, 1905, as follows. Case of a carpenter, seventeen years old. At eight years of age had dislocation of the elbow, at end of half a year all motions good, no further trouble. Ten days before entering clinic while flexing the forearm was struck a blow which knocked the inner side of the elbow against a table. There was immediate characteristic pain at the elbow, shooting into the finger, with increasing pain and disability. Poulsen used a small flap from the periosteum as well as a flap from the aponeurotic structures, suturing over the nerve with catgut stitches. The arm was put in extension, fixation bandages. In three weeks nerve held firmly in place, joint motions normal. There was no more pain, but on extreme flexion of the elbow there was a slight grumbling sensation in the fingers.

G Tisserand (*Luxations du nerf cubital*, Arch gen de méd, Paris, 1906, 1, 86-91) is opposed to this method, which covers the nerve with a periosteal flap. He thinks that in this there is danger of pressure on the nerve ultimately, especially in young persons, from proliferation of bone, the flap from the aponeurotic structures is all that is necessary. In this opinion I agree entirely.

BLANC and LISSIRAND (*Un Cas de Lésion du Nerve Cubital*, La Loire Méd., St Étienne, 1905, *xxiv*, 27-30) have reported one operated case as follows. Workingman, seventeen years old. Two months before in making a violent effort to lift a heavy weight from the ground, felt sudden pain in the left elbow at the moment of flexion of the forearm, "as if a nerve was torn." For the next month and a half each movement of flexion of the forearm caused pain which was not severe or disabling until fifteen days before operation, when the severity and the weakness in the hand compelled him to give up work. Nothing is said about the distribution of the pain into the hand at this time.

Examination. The region of the elbow showed no wound or abnormality when the forearm was extended. The motions of the joints were normal. In flexion it was noticed that when the forearm was brought to a right angle on the arm one could see in bold relief under the skin a cord jump suddenly from the posterior to the anterior face of the epicondyle. At this time the patient complained of lively pain along the internal border of the forearm and in the elbow-joint. Pressure on the displaced cord caused severe pain in the forearm, radiating into the ring finger and little finger. On palpation the groove back of the condyle was found empty. On extending the forearm the nerve was seen to jump back suddenly to its posterior position. There was no anesthesia in the nerve distribution and no muscular atrophy. The electrical reactions were normal. The ulnar groove was filled with fibrous tissue. This was removed and the nerve put back in the groove and fastened by a small flap of fascia from the aponeurosis which was sutured to the triceps muscle. Skin sutured without drainage and arm fixed in extension. Union by first intention. No pain since operation at any time. (Note—On the tenth day passive motion was made and the forearm put up in half flexion, and in eighteen days brought up to a right angle and at each change of position passive motion of the elbow-joint was done.)

The man was discharged cured December 20th, just a month after operation. All the movements of the forearm were free and without pain. The ulnar nerve remained in its groove. This patient had a persistent zone of hyperæsthesia in the distribution of the ulnar nerve along the border of the ring finger and the hypothenar eminence.

Up to 1904 only 15 operations for this condition had been reported. Abstracts of these cases together with a report of my first case were given in the previous paper, 16 cases in all. Since 1904 it has been possible to find only 6 additional cases with my second case now reported, bringing the total number of operations to 23. A study of these cases justifies the following conclusions.

Operation for this condition has every chance of effecting a cure. Only the severe cases, few in number and for the most part traumatic, need ever be operated upon.

Operation should never be undertaken for dislocation of the nerve alone, but only for the severe and disabling symptoms caused by the recurring dislocation

The simple operation of replacing the nerve in its groove and covering it over with a flap of fibrous tissue from the triceps fascia will be sufficient to hold it firmly in place. More elaborate operations of chiselling the bone or dissecting up periosteal flaps are unnecessary

BIBLIOGRAPHY

- Andrae Inaugural Dissertation, Greifswald, December 21, 1889
 Annequin Arch de Méd et de Phar Milit, Paris, 1890, Tome xv, p 432
 Blanc and Tisserand La Loire Med St Étienne, 1905, xxiv, 27
 Cobb, F ANNALS OF SURGERY, November, 1903
 Cohn Centralbl f Chir, 1904, 1400
 Collinet Bull de la Soc Anat de Paris, May 15, 1896
 Cotton, F J Boston Medical and Surgical Journal, August 2, 1900
 Croft London Lancet, 1891, p 1040, Transactions of the American Surgical Association, 1895, vol xiii, p 377
 Damas, E Valance le Bulletin Medical, Paris, February 9, 1901, p 119
 Drouard Lux et sublux du nerf cubital, These de Paris, 1896
 Geinats, V N Vrach Gaz, St Petersburg, 1906, xiii, 349
 Haim Deutsche Zeitschrift fur Chirurgie, Leipsic, 1904, lxxiv, 96
 Holm, A Hosp Tid, Kbenh, 1906, 4 R, xiv, 461
 Jopson Philadelphia Medical Journal, September 10, 1898, vol 11, p 524
 Kissenger Monatschr fur Unfallheit, Leipsic, 1903, x, 169
 Krause Vortrag in der Sitzung des Ärztlichen Vereins in Hamburg am 31, October, 1899 (Quoted from Momburg)
 Lozano, R Revista de Med y Cirurg Pract, Madrid, tome xliii, 1898 p 161
 MacCormac, Sir William London Lancet, 1891, p 1041, Transactions of the American Surgical Association, 1895, vol xiii, p 375
 Momburg Archiv fur klinische Chirurgie, Berlin, 1903, Band lxx, Heft 1, p 215
 Poncet La Semaine Med, p 93, 1888
 Rosenbach, F J Deutsche Zeitschrift fur Chirurgie, Leipsic, 1906, lxxv, p 300
 Schwartz, M Bull et Memoir de la Soc de Chir de Paris, tome xxii, 1896, p 202, (also Franc Medical, 1896, x, p 155) Bull et Memoir de la Soc de Chir de Paris, 1903, n s xxix, p 3
 Smith, G Munro British Medical Journal, February 11, 1893
 Stabb, E C Lancet, May 9, 1891
 Tisserand, G Arch gen de med, Paris, 1906, 1, 86
 Tsutsumi Inaugural Dissertation, Rostock, 1905

THE OPERATIVE TREATMENT OF RECENT FRACTURES OF THE FEMORAL SHAFT.*

BY THOMAS W HUNTINGTON, M D,

OF SAN FRANCISCO, CAL ,

Professor of Surgery in the University of California

As a preliminary step in this undertaking, it seemed wise to determine as accurately as possible the range of discrepancy in the length of the lower extremities of normal adults

It is generally believed that a difference of an inch or even more may exist in the measurement of normal limbs

Accordingly fifty subjects were carefully measured for me by Mr Sterling Bunnell, a senior student of the University of California, who submitted the following data

The greatest discrepancy in any individual amounted to $\frac{3}{4}$ of an inch (1.9 cm)

Average discrepancy in 50 subjects proved to be slightly under $\frac{1}{4}$ of an inch (.58 cm)

Discrepancy exceeded $\frac{1}{2}$ inch in 3 subjects (6 per cent)

Discrepancy equal to $\frac{3}{4}$ of an inch (1 cm) in 10 subjects, 20 per cent

Right leg longer than left 18, 36 per cent , left leg longer than right 25, 50 per cent , legs equal 7, 14 per cent

Hence it appears that in dealing with thigh fractures discrepancy in length of normal limbs exceeding one-half inch is to be reckoned with in only six per cent of all cases and that only in one per cent of cases will the difference amount to $\frac{3}{4}$ of an inch or more

As a secondary step I formulated a circular letter embodying the following queries, which was sent to all members of the American Surgical Association and to other surgeons of this country and Canada

1 What is your interpretation of the term "tolerable result" (*i e* , satisfactory functional result) in fractures of the Shaft of the Femur ?

* Read before the Medical Society of the State of California, April, 1908

2 What degree of shortening is compatible with satisfactory function?

3 Is a definite amount of overriding of fragments permissible from the modern standpoint?

4 Are you satisfied with the average results attained by conservative (non-operative) treatment?

5 Are you an advocate of operative treatment as a routine operative measure?

6 In operative procedure do you employ wire, nails, screws, staples or such an appliance as Parkhill's clamp?

7 Do you regard the danger of infection as contraindicating the operative treatment of simple fractures?

8 Has it been your habit to secure X-ray evidence of end-results on fractures of the femur?

Ninety-two answers were received. The data obtained from this source will appear elsewhere under appropriate headings.

The motive of this paper is

1 To determine finally, if possible, what shall be regarded as a satisfactory end-result in fractures of the femoral shaft

2 To ascertain whether or not anatomical replacement, and permanent fixation of fragments by operative interference is justifiable from the standpoint of infection and of improved end-results

It cannot be denied that results of conservative treatment in thigh fractures have not, as a rule, conformed to the high ideals which govern every modern surgical undertaking.

During the past two decades surgical activities have centred closely upon abdominal and visceral lesions, while interest and enthusiasm seem to have waned as regards fracture treatment in general. As a rule surgeons of acknowledged skill and broad experience have approached ordinary thigh fractures with a jealously guarded prognosis, a faintly cloaked confession of inability to restore normal relation and function, and, at the end, in a certain proportion of cases adroitly framed apologies for manifest defects or deformities have been too often a forced expedient.

In 1890 the American Surgical Association appointed a committee to determine what should be considered a satisfactory result in simple fractures of the shaft of the femur

The committee was composed of the following well-known gentlemen Dr Stephen Smith of the University of New York chairman, Drs D Hayes Agnew, David W Cheever, D W Yandell, Charles T Parkes, P S Conner, Charles B de Nancrede and Hunter McGuire

Smith's report submitted in 1891 was based upon opinions sent in by thirty-five members and was sanctioned by the Association It embodied an analysis and discussion of all points involved by the question at issue

His conclusions, slightly abbreviated, are as follows

A satisfactory result may be predicated when

- 1 Firm bony union exists
- 2 Correct axial relations are maintained
- 3 Preservation of correct relations of the anterior planes of upper and lower fragments
- 4 Shortening not to exceed one-eighth to one inch
- 5 Lameness, if present, is not due to more than one inch of shortening
- 6 When the conditions attending treatment prevent better results than those obtained

The doctrines herein set forth have been almost universally accepted by surgeons in practice, and to a certain extent have been recognized by Courts in medicolegal procedures

It is to be borne in mind that, in the opinion of most surgeons, "satisfactory result" is a very flexible term, applicable to widely varying conditions, while on the other hand, in every department of surgery, the exaction is for the nearest possible restoration of normal relation and function

Bloodgood, of Baltimore, in a personal letter says "Quite frequently with some shortening, due to overlapping or bending, patients are able to walk without special difficulty I would call this a satisfactory result," and adds, "It is remarkable how good function may exist with a great deal of shortening, provided that axial relations are maintained"

Harry M. Sherman, of San Francisco, believes "the term 'satisfactory result' is capable of two interpretations, one for non-operative, the other for operative treatment," intimating that anatomical adjustment is more probable following the latter method

My own feeling is that higher standards in fracture treatment should be maintained with a stricter compliance with anatomical requirements *Nor do I fear, that in departing from traditions, we shall tread upon dangerous ground from the medicolegal standpoint*

Since Stephen Smith set the pace, the science of radiography has unfolded many secrets affecting the status of fractures at all stages, and it is apparent that end-results which in former days did not challenge adverse criticism on the part of the patient, his friends or later professional attendants, are capable to-day of being shown to be, from the anatomical standpoint, faulty in the extreme

Whenever the X-ray as an official aid is accessible, it has become an indispensable factor, and the documentary evidence from this source is valuable through every phase of fracture treatment

With a large experience extending over a period of twenty-five years, I am free to confess, that without the aid of radiography, I am unable to determine with any degree of accuracy the status of many fractures at any time during the progress of repair. This is particularly true of fractures of the femur where fragments are deeply imbedded in muscular tissue, by which outlines are obscured and prominences are impossible of correct definition

In fracture treatment the surgeon is confronted by three exactions. First, the re-establishment of normal relations (interlocking of fragments), second, maintenance of perfect alignment, third, avoidance of rotation. And it may be added that failure to meet any of these conditions upsets one's calculations as regards the other two

Very many thigh fractures can be treated ideally under conservative methods. It is obvious that before operation is

to be considered, repeated and conscientious efforts at adjustment and permanent fixation must be made. Just as obviously, conditions attending certain fractures render them practically incorrigible from the standpoint of conservative treatment.

Von Bergmann refers to the accident statistics of Haenel as follows: of 121 fractures of the femur only 39 recovered fully. In 75 the injury was permanent with average loss of earning capacity of 28 per cent.

Fractures of the upper third of the femur are notably obdurate. Many years ago Eichsen stated that in fractures of the upper third of the femur results were invariably unsatisfactory.

In 1890 Allis, at the close of an exhaustive treatise upon "Fractures of the Upper Third of the Femur," makes this significant and manifestly too sweeping statement: "The conversion of a simple into a compound fracture offers the only means of accurate diagnosis, and the only method of rational treatment. Patients and surgeons who stop short of this must compromise with best results."

By the action of certain muscles the upper fragment is rotated outward and drawn upward, while other muscles acting upon the lower fragment separate it widely and assure overriding, rotation and deformity.

My own experience with fractures of the *middle third*, verified by repeated X-ray evidence, has convinced me that ideal adjustment is likewise difficult if not impracticable. Especially is this true of transverse fractures at this point. In several instances of this sort I have made repeated and conscientious efforts at securing apposition, and each time the radiogram through anteroposterior and transverse planes has shown wide separation and overriding.

I wish to emphasize that shortening to an appreciable degree in transverse fractures of the femur means invariably overlapping, a condition which my own standards do not tolerate, and further, that the nearest possible approach to anatomical reposition and correct alignment should be recognized as not beyond the requirements.

During the past two years I have treated conservatively four thigh fractures with the following results one was positively intolerable because of overriding, two were imperfect but in the ordinary sense satisfactory, one was ideal

Another consideration is of paramount importance With overlapping, union is effected with far greater difficulty and at the expense of double the time required when anatomical replacement has been secured

In my opinion, a very large percentage of all cases of delayed or non-union can be attributed to faulty adjustment

It is true that untoward results will be manifest less often at the hands of men of supreme intelligence, men who are trained in the use of appliances and methods such as those of Bardenhauer

I have gone over the volume on fractures by this distinguished author aided by the splendid illustrations which it contains, and I am strongly of the opinion that few patients would submit to confinement in a fixed position during a period of weeks or months

Furthermore the matter of adjusting multiple traction appliances, exerting force in from two to six different directions simultaneously would involve the average surgeon in overwhelming difficulties

Were it a fact that operations for the relief of impossible conditions, such as loss of function, persistent pain, delayed or vicious union were easily capable of correction by late operation, any argument for so bold a procedure as an initial operation would have less weight

Long experience in dealing with this particular lesion, and frequent opportunities of inspecting and correcting unfortunate results, has led me to two conclusions

I That the so-called "tolerable" or "satisfactory" results are too often either intolerable or unsatisfactory, overriding of fragments, shortening sufficient to entail permanent limp, angularity and rotation are not rarities in surgical experiences

Of 92 surgeons appealed to, 69 consider shortening per-

missible to the extent of one inch or more, while to limit the shortening to $\frac{3}{4}$ of an inch and only $\frac{1}{2}$ to $\frac{1}{4}$ inch.

Appreciable overriding is considered permissible by 75, not permissible by 17.

These opinions, based upon experience, indicate strongly that standards of excellence are not in accord with modern ideals.

Arbuthnot Lane says plainly, "The frequent occurrence of mechanical disability must be known to surgeons generally. It seems little short of ridiculous to read the statements of surgeons, that such condition is a rare sequence of fracture."

2 The operative correction of such conditions, after the lapse of many weeks or months, is to be regarded as one of the most difficult of all undertakings in the realm of bone surgery.

A long train of humiliating failures have attended corrective measures for the relief of unsatisfactory thigh fractures, and it is not strange that such operations are approached with hesitation or positively declined. The first requirement is a long deep incision to expose the deformity and enable the dissection to be carried entirely around it. Bone surfaces, firmly or indifferently united, are to be chiseled apart, following vaguely defined lines of cleavage. Extensive deposits of fibrous or bony material must be removed, often the latter, following the accidental distribution of shredded periosteum, reach far afield and must be torn from their lodgement along fascial planes or within muscle sheaths. The ends of fragments, having lost their original detail, are smooth and conical if not eburnated, and fixation is only possible after removal of more or less of their apices.

If many weeks or months have elapsed, muscles will have permanently contracted to a degree that will require shortening of the bone from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches. All this is to be followed by drilling fragments and placing of one or two wires, nails, or other appliances. He is a clever operator who can complete such a task in two hours or even more. Exten-

sive unavoidable mutilation of tissues, and further dislodgement of periosteum invite infection, interrupt wound repair and, in a liberal proportion of cases, ensue disaster

The estimate of the dangers of sepsis in fracture operations in the minds of competent surgeons is as follows sepsis was considered as either a serious menace or prohibitive by sixty-three, as not a contraindication by twenty-nine

That these opinions are based very largely upon the statistics of corrective, *i e*, late, operations, there is little doubt as less than a score of surgeons appealed to were able to report initial operations while practically all have dealt with late conditions Only 22 out of 92 conceded the propriety of initial operations and several of these have had no personal experience along this line

Caillon P Flint, of New York, writes that from September, 1906, to October, 1907, he personally inspected 834 breaks at the Roosevelt Hospital There were 53 operative cases, of which 29 were undertaken after delay for corrective purposes In something over two hundred fracture operations sepsis was a complication in but four He believes in early operation where the following conditions prevail, *viz*, all breaks either near the upper or lower ends or at the middle of shaft with great displacement or where efforts at replacement are futile

In his excellent work on "Operative Treatment of Fractures," Arbuthnot Lane of London says, "In looking through text-books I find any number of reasons given for non-union of broken bones, the vast majority of which are, in my opinion, utterly without foundation I have never seen one instance in which union would not have resulted if efficient operative measures had been adopted "

In *Progressive Medicine*, December, 1907, Bloodgood refers at length to fracture work as conducted in Vienna Ranzi reports that of fifty cases operated in Von Eiselberg's Clinic only three or 6 per cent were for fresh fracture He emphasizes the dangers of sepsis, inclines to conservatism and contents himself with good functional results

Bloodgood's comment is suggestive "In my opinion the argument against immediate operation is not the risk of infection but that radical measures are not absolutely necessary "

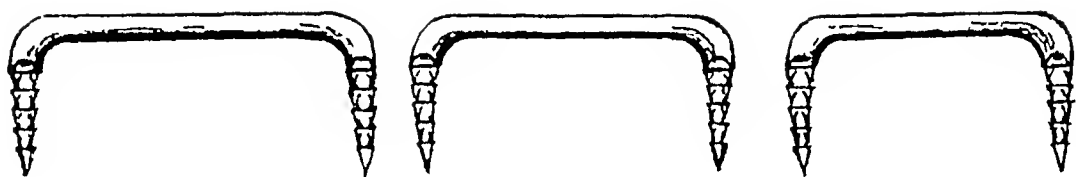
The materials heretofore used and at the present time widely in vogue for the purposes of fixation in fracture surgery are, to my mind, manifestly open to adverse criticism All text-books with which I am familiar suggest, for this purpose, the use of chromic gut, kangaroo tendon, wire, nails, screws, plates, ferrules, or some form of complex apparatus such as the clamp of Parkhill

I have long since recognized serious objections to wire or any similar material, for two reasons First, lack of stability After a careful adjustment of wire or tendon, it will be found that the slightest movement of the distal fragment will loosen the suture to such a degree as to admit of displacement But the more glaring, and to my mind the fatal defect of the suture lies in the difficulty of its application After having secured approximate replacement, the fragments must be again widely separated to admit of the introduction of the suture, first through a drill hole in one fragment from without inwards, thence through the medullary canal of the second fragment to complete the loop This entails much loss of time and an added measure of traumatism to soft parts sufficient to ensure, in many cases, complications through infection Furthermore wire is prone to break when twisted tightly

In transverse fractures the application of the screw or nail is irrational and inefficient The appropriateness of either in oblique fractures will be shown further on Numerous authorities, notably Edw Martin of Philadelphia, have written enthusiastically of the value of the screw and plate To this I raise no positive objection further than it is difficult of accurate application and entails a somewhat complex technic

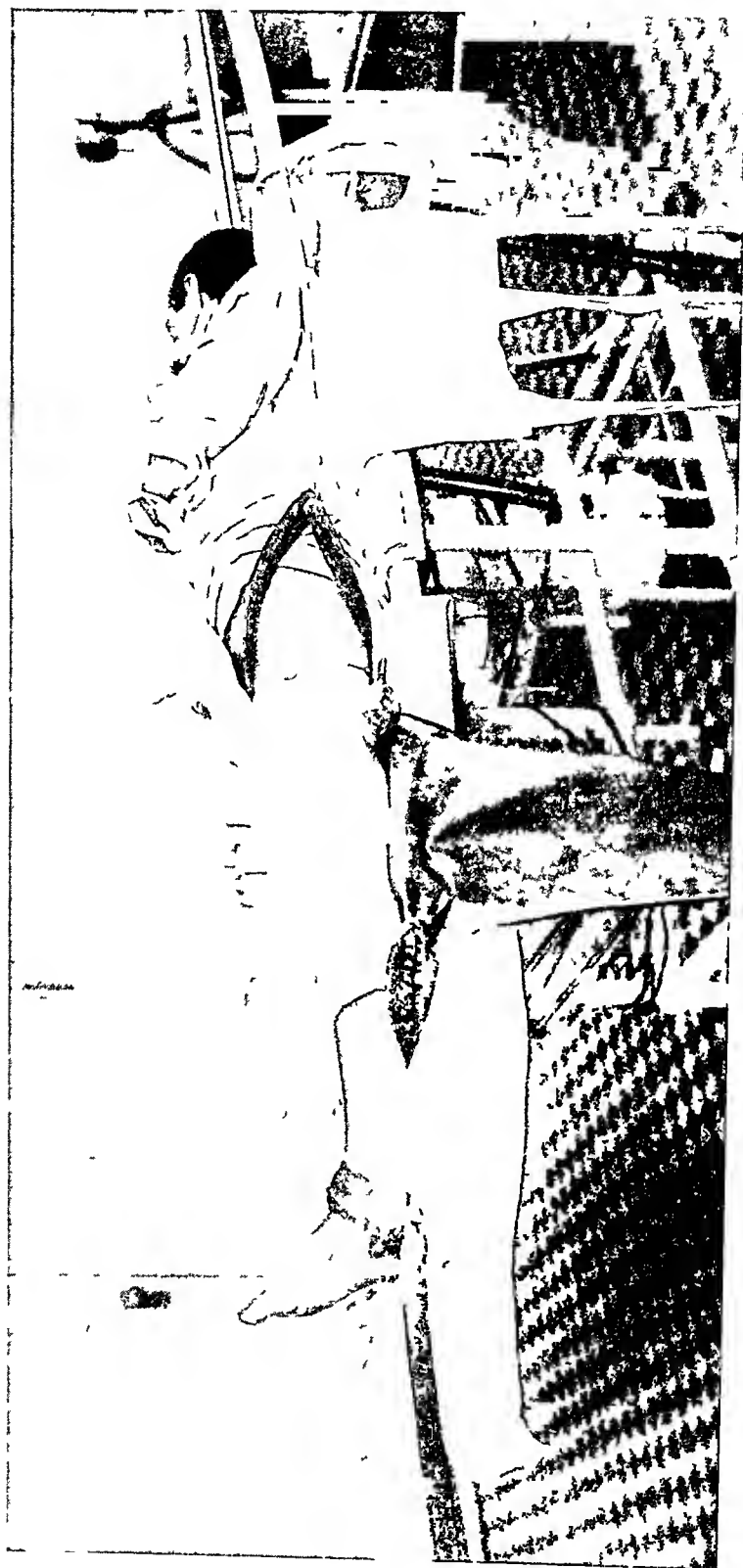
Ferrules have practically been abandoned, probably because of interference with bone nutrition at point of contact Flint states that he has satisfactorily used a bone cylinder to be so placed within the medullary cavities of each frag-

FIG 1



W ARBUTHNOT LANE'S STAPLES

FIG 2



Traction apparatus for treatment of fracture of the shaft of the femur

ment as to prevent displacement. The contrivance is certainly ingenious but when it is considered that the bone peg must be a recent specimen in order to secure ultimate absorption, that it must be of proper diameter and that its adjustment involves a complex procedure, it will probably not appeal to most surgeons.

The principle of the clamp involving protracted exposure to infection through metal cylinders, reaching from the bony fragments through the skin into the outer world, to be engaged in a horizontal bar has been elaborately set forth by Lambotte of Brussels. The apparatus, for obvious reasons, does not appeal to me. It seems to me cumbersome and awkward in the extreme and, entirely aside from the evident menace of sepsis, which I associate with it, I feel confident that the steel staple is a far simpler appliance, and will ultimately supplant it.

W. Arbuthnot Lane of London has repeatedly called attention to the value of the steel staple as a substitute for other fixation material wherever it is applicable. He employs a modification of the staple as devised by Dr. A. Jacoel. (See Fig. 1.)

Lambotte also has employed staples of slightly different type, with three or four legs which will probably be found valuable in comminuted fractures, particularly of the epiphysis.

Rixford reports employment of staples six times on five patients and Sherman four times without an infection. I have used staples in one and wire in five cases. Infection in one of the latter ended in a barely tolerable result.

In dealing with the technic of operative treatment of simple fractures of the femur, I have emphasized the necessity of simpler methods and more efficient fixation. A distinct advantage lies in making provision for systematic mechanical traction which will ensure reposition of fragments without undue violence to soft tissues after exposure of the parts.

The apparatus used at the University Hospital is illustrated in Fig. 2. Its details were worked out and exemplified by Dr. Harry M. Sherman and those who have had the oppor-

tunity of observing it in use regard it as indispensable This is but the new application of an old principle and has possibly been used by others, though I find no allusion to it in the literature

A skein of heavy woolen yarn is passed over each leg to serve as a medium for perineal traction To each of these is attached a cord whose distal ends are tied to a ring in the end wall of the room Another similar skein is applied to the ankle of the affected limb with a clove hitch To this is attached a small set of pulleys which, in turn, are anchored to the wall at the foot of the operating table and the pulley rope is intrusted to an assistant

Under the most careful aseptic precautions a comparatively small incision will suffice to uncover one or both ends of fragments At this point the value of the traction apparatus is clearly apparent The fracture being a recent one, no elaborate dissection is requisite Having identified the line of fracture, traction by the pulley exerted upon the overlapping bones serves to bring the lower fragment slowly downward until it is capable, by external pressure upon both fragments, of being placed in exact axial relation If the fracture be transverse or nearly so, slight relaxation of tension will serve to interlock the fragments The operation now becomes delightfully simple With the fragments interlocked, rotation being avoided, a drill hole is sunk in each fragment from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch from the fracture line, the interval being determined by the length of the staple to be introduced The placing of the staple is materially aided by the use of an ordinary carpenter's nail set, each limb of the staple being gently driven into the corresponding drill hole We now have the fragments firmly united in exact anatomical relation by an unyielding steel splint If the fracture be oblique or spiral the traction principle is alike applicable Exact reposition being thus obtained, maintenance of proper relations is secured In these cases the staple may or may not be found available If the conditions are such as to throw a doubt upon the efficiency of one or more staples applied at each end of the

FIG 3

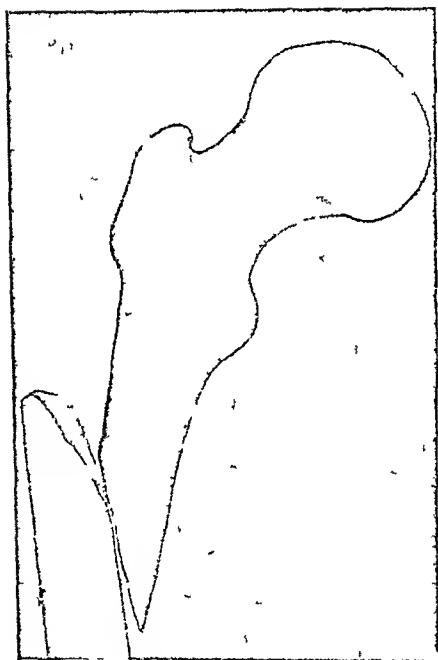
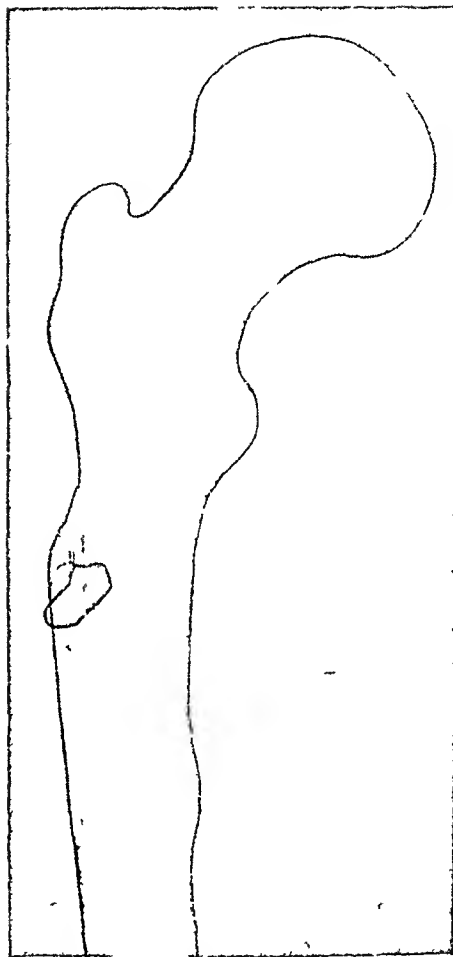
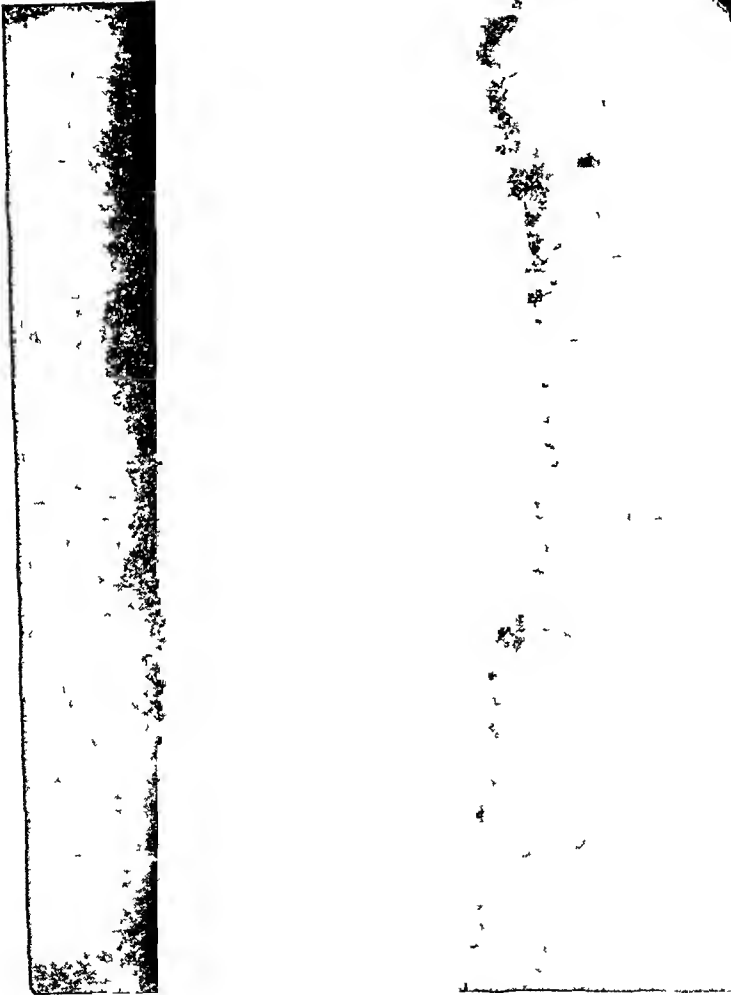


FIG 3a



Skiagram tracing showing original condition and end-result after wiring

FIG 8



Showing end result after use of staple in a transverse fracture

FIG 9

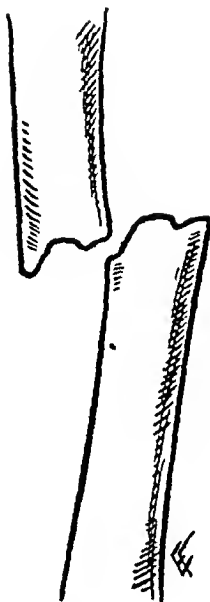
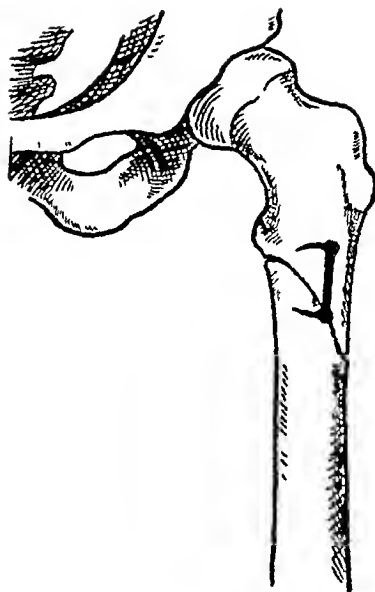


FIG 9A



FIG 10



Figures 9 and 9A, showing overlapping associated with non-union, at the end of sixteen weeks. Good union secured in five weeks, after use of staple without shortening. (Tracing from skiagraph.)

Showing oblique subtrochanteric fracture ten days after use of staple.

fracture line, a single steel screw of the proper length and calibre may be used as a substitute. By it the permanency of adjustment may be absolutely assured.

Closure of the wound merits a passing word. A continuous catgut suture should be applied from the deepest layer of soft tissues outward so as effectually to obliterate the dead space overlying the fracture line and staple.

Drainage, in cases where there is extensive oozing, is probably a safeguard, but in the average case I believe it is to be omitted on the ground that it affords an avenue of ingress for infection.

The wound, having been carefully protected by a gauze dressing and before pulley traction is wholly released, a plaster of Paris spica is applied from the lower leg to the waist line.

To avoid slight curvature at point of fracture as has occurred in several instances, it is best to employ permanent traction apparatus for a period of a week or ten days succeeding operation.

CONCLUSIONS

- 1 The term "satisfactory result" is too elastic and does not conform to any standard.

- 2 The two plane radiogram when available affords the most reliable diagnosis, and determines the plan of treatment.

- 3 The possibility of infection is not a prohibitive menace.

- 4 Operative wounds are less susceptible to infection in initiation than in late corrective procedures.

- 5 Approximate anatomical reposition is essential to quick repair and ideal result.

- 6 In oblique fractures slight overriding is permissible.

- 7 In transverse fractures appreciable shortening is due to overlapping of fragments, and is incompatible with good surgery.

- 8 Mechanical traction during operation is indispensable.

- 9 Steel staples (or screws in oblique fractures), because of ease of adjustment and efficiency, have proven superior to other methods of fixation.

REDUCTION OF SUPRACONDYLOID FRACTURE OF HUMERUS,

(EXTENSION TYPE) BY PRELIMINARY HYPEREXTENSION OF THE FOREARM,
AND MAINTENANCE OF THE REDUCTION BY EXTREME FLEXION

BY WILLIAM C. LUSK, M D,

OF NEW YORK,

Assistant Visiting Surgeon to Bellevue and St. Vincent's Hospitals, Professor
of Clinical Surgery at the New York University and Bellevue
Hospital Medical College

Method of Reduction—In this connection attention is especially directed to the layer of periosteum (Case I, Fig 1) stripped off from the posterior surface of the upper fragment for some distance above the seat of fracture, which at the same time remains attached to the posterior surface of the lower fragment, thus forming a hinge on which the latter can be swung forward and backward and turned upward and downward. This anatomical condition is pictured in Scudder's "Treatment of Fractures." It is the object of this paper to demonstrate that this periosteal attachment between the fragments is obviously the active deterring influence in the reduction of this fracture. Since the lower fragment as it swings backward on the periosteal hinge describes the arc of a circle, there must be a tendency, though slight within so small an arc, for the posterior edge of this fragment, which is the line on the latter from which the periosteal hinge takes its departure, to become raised to a higher level than it was in its normal position. With the position of the lower fragment, thus influenced by this restraint on its posterior border, it can be seen that any manipulation which tilts the anterior edge of this fragment upward, as flexion of the forearm, tends to lock the fragments together, thereby obstructing reduction, while a manipulation tilting the front of the lower fragment downward, as would be produced by hyperextension of the forearm, would throw the fractured surfaces apart at an angle which

opens anteriorly, and at the same time would relax the periosteum behind, thus unlocking the fragments and placing them in a position favorable to reduction. In this position of hyperextension the lower fragment can, with a little downward traction, be swung unobstructedly forward until the loosened periosteal layer comes again into its normal relation against the posterior surface of the upper fragment, when flexion of the forearm will tilt the anterior edge of the lower fragment upward, thereby completing the re-establishment of the normal bony relations. The test of having obtained a complete reduction of the deformity, unless interfered with by swelling, would be the ability to secure extreme flexion of the forearm.

Maintenance of Reduction—After the fracture has been reduced the periosteum behind will prevent forward displacement of the lower fragment, while the position of extreme flexion of the forearm prevents forward riding of the upper fragment by the pressure exerted on the latter by the parts within the flexure of the elbow. Fig. 2 of Case IV shows how the coronoid process can come against the anterior margin of the upper fragment in extreme flexion and hold it in place. The proposition is herewith advanced that *extreme* flexion of the forearm is essential in order to maintain complete reduction, since otherwise pressure is not brought firmly against the front of the lower end of the upper fragment. Swelling at the outset may interfere with getting the amount of flexion necessary to maintain a complete reduction. A thin layer of absorbent cotton is placed between the skin surfaces at the flexure of the elbow to prevent irritation, besides which no constricting or compressing agent is introduced at this situation. Then the skin surface of the extremity is protected with a flannel bandage and a plaster of Paris splint is applied. The plaster bandages pass first circularly around the wrist and the upper part of the arm, encasing each singly, and then around both together down to the elbow (Case III, Fig. 3). The former turns prevent the splint from dropping off, the latter maintain the flexion. Neither flannel nor plaster

bandage should pass across the flexure of the elbow, as this would destroy the position of extreme flexion. In the literature on the subject Broca¹ commenting on the method of treating this fracture in the extended position as advocated by Berthomier² and by Laroyenne, states, "The fracture can with certainty be reduced by traction in the extended position with direct replacement from before backward since this completely overcomes all muscular action." Both Broca and Scudder favor treatment in the acutely flexed position. Scudder, in the legend of an X-ray plate showing the deformity of this fracture, says, "It is often impossible to reduce this fracture without incision."

Cases—The important features are indicated in the legends of the illustrations. The first case was one with tremendous swelling. Several attempts at reduction were made before the final partial reduction was secured on the 20th day (Case I, Fig 3). In one of these attempts, where strong traction was made with a bandage in the flexure of the joint while the forearm was forced into flexion, an evidence of the periosteal hinge being a deterrent factor to reduction was demonstrated by the X-ray of the result which showed that the lower fragment had been tilted backward and the lower end of the upper fragment was in relation with its anterior surface. Early in the history of this case the great swelling precluded the employment of acute flexion in maintaining the fragments in reduction. The other three cases were all reduced by hyperextension preceding reduction, the forearm in each case could be readily brought up into forced flexion in which position the fracture was set in plaster, and all three cases had excellent results. Case IV was the only one not set under anæsthesia.

¹ *Leçons Clinique de Chirurgie Infantile*, p 93

² *Congres français de Chir*, 1875 and 1888

Fig. 1



CASE I (1) Age 11 12th day Condition before attempted reduction A linear shadow indicates the situation of the periosteum stripped from the posterior surface of the upper fragment for some distance above the seat of fracture, and at the same time remaining attached to the lower fragment *The primary relaxation of this periosteal hinge by hyperextension of the forearm is essential in the reduction of this fracture*

FIG 2



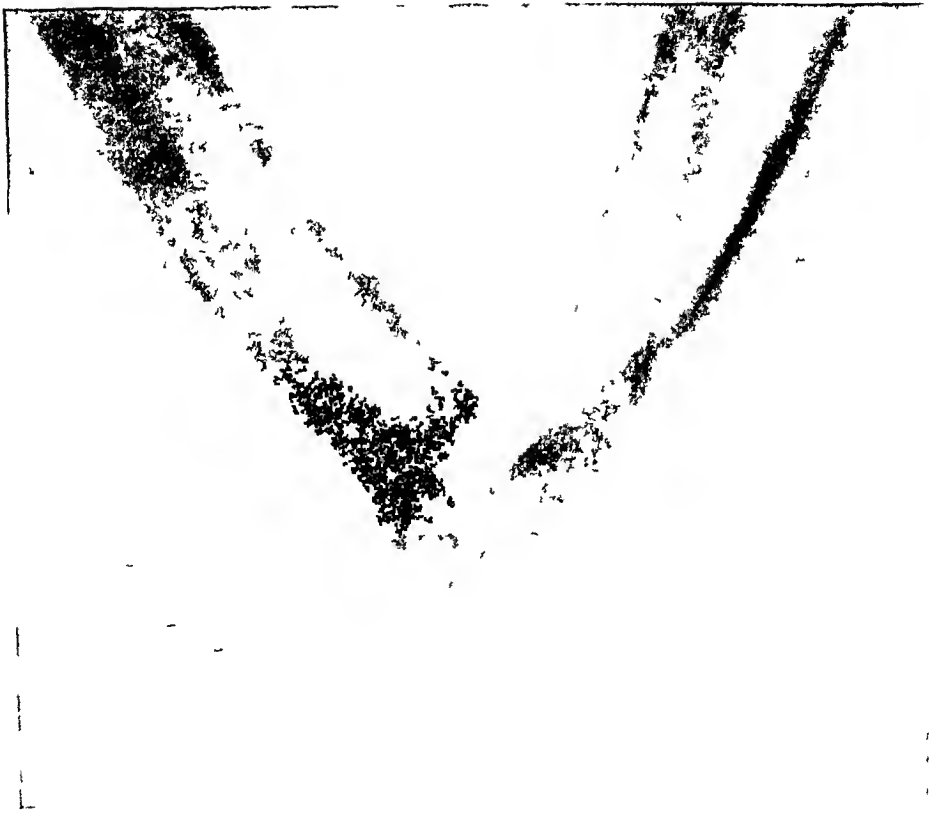
CASE I (2) shows result of attempted reduction 14th day by holding the forearm at a right angle and then with downward traction on the condyles pressing backward on the upper fragment and forward on the olecranon process. The tension of the periosteal hinge unrelated by this position of the forearm had held the fragments locked in the position of deformity, thereby preventing reduction by this manipulation

FIG 3



CASE 1 (3) Shows partial reduction 20th day. With the forearm hyperextended the lower fragment was readily pressed forward and the forearm then came up into acute flexion with perfect ease. *Having previously failed to secure reduction in this case without hyperextension of the forearm, the efficacy of this method would seem to have been herewith demonstrated.* An iron spring and felt pads were relied upon chiefly to maintain the reduction the forearm being thereby held in acute but not extreme flexion. The subsequent three cases demonstrate the possibility of maintaining a more perfect reduction simply by the position of extreme flexion.

FIG 4



CASE I (4) Shows result after 5¹ months Forced flexion Acute flexion could be gained by force for about fifteen months subsequent to which an obstructing callus developed Forced extension would bring the forearm quite a little below a right angle

FIG 5



CASE II Age about 5 X-ray showing result $3\frac{1}{2}$ months after setting by hyperextension of forearm with downward traction on condyles and forward pressure on the lower fragment and then bringing the forearm into extreme flexion Some swelling at the time of setting *Result* Lacks about three degrees of full extension otherwise perfect motion

FIG 6



CASE III (1) Age about 6 Original deformity

FIG 7



CASE III (2) Fracture reduced by the hyperextension method and set in plaster in the position of extreme flexion. After making three or four unsuccessful efforts at reduction the lower fragment finally slipped forward with a little snap and the forearm came easily up into extreme flexion. *Result* Perfect motion.

FIG 8



CASE III (3) Plaster of Paris splint holding forearm in extreme flexion

FIG 9



CASF IV (•) Age 60 Original deformity

FIG 10



CASE IV (2) Fracture reduced by the hyperextension method, and set in plaster in the position of extreme flexion. The X-ray shows how the coronoid process in this position of the forearm by impinging on the anterior margin of the upper fragment can influence the maintenance of reduction. *Result* 7 months after removal of the plaster the patient wrote that his arm was all right.

TWENTY-FIVE HUNDRED CASES OF GAS-ETHER ANÆSTHESIA WITHOUT COMPLICATION '

BY J J A VAN KAATHOVEN, M D ,

OF PHILADELPHIA,

Assistant Instructor of Surgery, Instructor of Anæsthesia at the University
of Pennsylvania

THE recent inroads of surgery into the domain of medicine have not only largely increased the number of operations, but have introduced so many extensive proceedings requiring prolonged anæsthesia that the problem of the administration of anæsthetics has been raised from a comparatively trivial to an important position. The surgeon fully realizes that to a large degree his success depends upon his anæsthetist, that many a skilfully performed operation has been rendered useless by clumsily administered ether and that many a convalescence has been unduly prolonged by over-anæsthetizations. Still the progress of this art has not been commensurate with surgery's advance. We still see, too often, patients profoundly shocked and deeply cyanosed in the hands of inexperienced men—perhaps in those of an obliging practitioner, entirely incompetent to take this important duty upon his shoulders. To a certain extent the text-books are responsible for over-etherization. It is usual to find the statement that surgical anæsthesia requires the absence of all reflexes. This is obviously erroneous teaching and leads to gross over-use of the drug.

A glance at the records and statistics of spinal anæsthesia suffices to show that at this stage it has not approached the usefulness of general narcosis. The mortality is variously estimated at from $\frac{1}{10}$ to $\frac{1}{2}$ per cent. Failure to produce anæsthesia occurs in 4 per cent of cases according to Bier, 14 per cent according to Moynihan, 10 per cent according to

* Read before the Philadelphia Academy of Surgery, April 6, 1908

Doderlein, etc. The after-effects are likewise more severe, 10 per cent suffering from severe persistent headache, many have paralysis, nausea and vomiting is not infrequent. Rigidity of the muscles of the neck has been observed many times as well as untold more unusual complications.

An attempt to collect statistics as to postoperative complications and mortality from ether anæsthesia, showed a lamentable absence of records, both in the literature and hospital reports. In three of our leading hospitals no statistics whatever could be collected—in a fourth a list of 1800 cases was traced, with 18 cases of pneumonia, thirteen of which were fatal, giving a percentage of 1 per cent of pneumonia and of 7 per cent mortality. This is unusually high, which fact can be partly explained by the type of cases brought to this institution. As in many others, anæsthetization in *this* hospital is the duty of the junior resident, who is usually inexperienced. It is therefore a more or less fair example of statistics of etherization and its mortality in the hands of unskilled men, especially as these records do not show deaths from any of the other complications of ether anæsthesia, such as renal failure, acute cardiac dilatation, apoplexy and shock.

The present series of twenty-five hundred cases without serious complications and absolutely without pneumonia or bronchitis forms therefore a marked contrast.

A word as to what should constitute a complete surgical anæsthesia. It is that degree of sensory and motor depression required to enable the surgeon to complete his operation unhampered by movement or rigidity of the patient's muscles, and not one whit more. From this definition it obviously follows that the degree of anæsthesia varies with each operation and each individual, which fact the competent anæsthetist keeps constantly in mind. The signs and symptoms of sufficient narcosis vary likewise.

In a general way it may be said that complete surgical anæsthesia is indicated by a pupil reacting sluggishly to light, a regular noiseless breathing, a good color, muscular relaxation and absence of cutaneous reflexes. The best guide is the

pupil, but unfortunately in from 85 to 90 per cent of cases it is not reliable during the whole time of narcosis. We find irregularity, inequality, absolute fixation of one or both pupils, etc., etc., in the above percentage of cases. This sign failing the respiration furnishes the best gauge. Close observation of the rhythm, the depth and the sound of breathing will almost invariably indicate the return of reflexes. The irritating vapor causes reflex contractions and consequently a more noisy, more hurried or more spasmodic breathing. Often the alteration is ushered in by one deep inspiration.

It is rarely necessary to carry the anæsthesia beyond a point where slight reflex inhibition of respiration is occasioned by administration of fresh ether.

To keep the patient on the borderland between consciousness and unconsciousness requires the absolute concentration of the anæsthetist. The subject's degree of narcosis varies from minute to minute. It is impossible to watch the details of the operation, or do anything but observe the changes in the patient's condition. It is much easier for the etherizer to carry the anæsthesia into the deep third stage with absolutely fixed dilated pupil, shallow respiration, cyanosis and increasing pulse rate. He then may follow the operation for minutes at a time or otherwise amuse himself, but he does so at the expense of the individual temporarily in his care. Ether is an irritant depressing poison, and each drop needlessly administered increases the danger to the patient's life, and decreases his power of resistance, so sorely needed in his period of convalescence.

In my hands the best results have been obtained by the use of nitrous oxide as a preliminary, followed by the gauze drop method. This has the following undisputed advantages. Nitrous oxide is by all means the safest anæsthetic we have, a series of 300,000 cases without a single death having been recently reported. It is not irritating and therefore greatly enhances the patient's comfort. All the choking, gagging and struggling so often seen where ether alone is used is eliminated. It greatly reduces the length of time required to

produce surgical anaesthesia, the average being from seven to eight minutes, and likewise greatly reduces the amount of ether required. This is especially true, as it is a well-known fact that it often requires as much, or more ether to anaesthetize a patient as it does to keep him under its influence for a considerable length of time. Its disadvantages are nitrous oxide requires a more or less bulky apparatus, it is expensive, and in about 50 per cent of cases, principally males and children, leads to an increased secretion from the respiratory mucous membrane. This last disadvantage would be an objection indeed had we no way to prevent, or at least to limit it. The most efficient preventative is the administration of a hypodermic injection of a full dose of morphine and atropine twenty minutes before the anaesthesia is commenced. This has many uses. The morphine quiets the patient, and to some extent depresses the nervous system so as to limit the amount of ether required. The atropine controls mucus secretion. Preliminary sprays of adrenalin and cocaine solution are also of some use. A thorough spraying of the mucous membrane of the nose and throat furthermore eliminates the rare danger of reflex cardiac inhibition occasionally observed as the result of the first administration of ether. If mucus is secreted in excess, notwithstanding these preliminary precautions, great care is necessary. Under no circumstances should such a patient be deeply anaesthetized—never to the point where inhaled mucus ceases to cause a reflex cough. The common practice of swabbing out the mouth and throat by gauze or other sponges is worse than useless, mucus reappears in less than two minutes and the friction of the sponges increases the flow. Raising the patient's shoulders allowing the head to extend fully while placed on its side allowing the mucus to flow into the cavity of the cheek thence leak out at the angle of the mouth, is the best treatment for this condition. Occasionally repeated sprayings and another dose of atropine helps to control the ceaseless flow.

As to the administration of ether itself the open method, and the most open one, namely, gauze, was invariably used

Pads about four by five inches and about eight layers in thickness form the most convenient method of administering the drug. The concentration of the vapor may be regulated by the number of layers of gauze employed. Sixteen is about the average number, children requiring less, women less than men, the latter frequently calling for twenty-four layers. If great concentration is required the ether may be dropped upon the under gauze and then covered by an overlaying pad, which will practically exclude the air. More ether is required by the gauze than by any other method, the average amount for men being seven to eight ounces for the first hour, five or six for women. After this time the amount is greatly reduced, especially if a morphine preliminary has been employed, it not being an unusual occurrence to have thirty minutes elapse without the necessity for more vapor. Average amounts of ether required per hour are of no value statistically inasmuch as they vary so greatly with the individual.

If the anæsthetist observes the precautions cited above he will be enabled to carry on his narcosis without endangering the patient's life from over-etherization, which may lead to shock, inhalation pneumonia, kidney complications and great physical depression, reducing vital resistance and healing powers during convalescence.

The management of a so-called difficult case often taxes the ingenuity of the most experienced. Every one knows that notwithstanding the greatest care and knowledge it is sometimes impossible to completely relax some individuals. The type occasioning these difficulties is usually the fat, flabby, plethoric, short-necked male, addicted to the use of alcohol, whose mucous membranes are in a constant state of congestion, and whose arteries are sclerotic. This class of patients run great danger from complete ether narcosis. Their resistance is low, hence pneumonia is more likely to follow inhalation of infected mucus, almost always profuse in these cases. Their arteries are brittle, hence subject to apoplectic rupture, caused by the cyanosis so often the result of the early administration of ether. Their kidneys are, as a rule, unpaired

and therefore likely to suffer from the anæsthetic, best results in these cases were attained from the following precautions. Twenty minutes before the anæsthesia a very full dose of morphia and atropine is injected hypodermically, the chest is covered by a cotton pneumonia jacket. Immediately before administration of ether, the mouth, nose and throat is thoroughly sprayed with a 2 per cent eucaine solution. Then a mouth-gag of the Whitehead type is inserted and the preliminary nitrous oxide commenced. When the patient is unconscious, ether is substituted in moderate concentration,—about sixteen layers of gauze moistened with ether being sufficient. At this stage frequently the patient spasmodically and reflexly fixes the jaws defying all attempts to open them, respiration ceases leading to profound cyanosis and the increased blood pressure dependent thereupon, which in turn may cause the rupture of sclerotic vessels. Atropine and morphia will decrease this tendency, but not eliminate it. The presence of the previously inserted mouth-gag saves the situation inasmuch as it is easy to open the jaws, pull the tongue forward, open the larynx and relieve the cyanosis.

If after ten minutes of administration of ether the patient shows no sign of relaxation I change off to chloroform through an Esmarch inhaler, unless contraindicated by the cardiac condition. By observing these precautions it is usually possible to handle these cases in the safest and most satisfactory manner.

A word as to the after-effects of ether anæsthesia. Nausea and vomiting are perhaps the most constant. This annoying, and at times dangerous complication, is greatly reduced by the gas-ether method. In a recent series of one hundred cases anæsthetized by this method by students under my instruction the following results were obtained, persistent vomiting (48 hours) in one case, a gall-bladder operation, the condition being ascribed to a low degree of acute gastric dilatation, 81 per cent did not vomit at all after regaining consciousness, the remaining 19 per cent had varying amounts of gastric distress during the first twelve hours, in a few

continuing during the first twenty-four hours. The use of oxygen and inhalation of vaporized vinegar have been given up after a thorough trial. If the patient be not over-anæsthetized oxygen is not needed, because there is no cyanosis, and the patient will regain consciousness within ten minutes after the last suture is placed, often moving and talking at random immediately after completion of the operation. The administration of oxygen did not seem to improve upon the statistics given above. A similar conclusion was reached after the use of vinegar.

Ether burns of the face never occur when the gauze drop method is adhered to. If the ether be spread over a sufficiently large evaporating surface and not allowed to drop in one place it will be found that the under surface of the gauze pad is entirely dry. In no case has an ether burn resulted in this series, nor in any of the cases anæsthetized by students.

The advantages of this method are. Its relative safety, comfort to the patient, the time and ether saved in anæsthetization, freedom from complications, such as bronchitis, pneumonia, annoying nausea and vomiting, shock and reduced vital resistance.

In conclusion I would make a plea for less profound anæsthesia in all cases, for rules preventing the junior resident from giving anæsthesia, unaided, and for the more extensive instruction of this art in our medical schools, in the light of its daily increasing importance.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting Held April 8, 1908

The President, DR JOSEPH A BLAKE, in the Chair

STRANGULATED FEMORAL HERNIA, RESECTION OF INTESTINE

DR IRVING S HAYNES presented a woman of 40, who was admitted to the hospital on March 3, 1908. She had had eight full-term pregnancies and one miscarriage. About nine years ago she had had an attack of pain for a few hours in the lower part of the abdomen, more pronounced on the right side, and extending up toward the epigastrium. A second similar attack was felt some years later.

Her present attack, which began 25 hours prior to her admission to the hospital, came on suddenly with vomiting and pain in the right lower quadrant of the abdomen. The bowels were constipated. Her pulse on admission was 84, temperature, 99.4. Her condition was apparently so favorable that Dr Haynes said he was not informed of her admission, and he did not see her until the following morning. Her pulse at that time was 72, temperature, 98.6. She complained of cramp-like pains in the epigastrium, and at long intervals raised some gas. She had on three or four occasions vomited a greenish fluid, her bowels had not moved.

Examination showed a small, hard, slightly sensitive femoral hernia, as large as an English walnut. An immediate operation was done, and through a two and a half inch incision a black loop of intestine was disclosed, three inches in length. There was no omentum in the sac. The constriction at Gimbernat's ligament was freely divided, and hot applications used for a quarter of an

hour As the intestine remained black and lustreless, it was resected and an end-to-end anastomosis made with a double row of stitches Three kangaroo tendon sutures were used to unite Poupart's ligament to the pectineal fascia and ligament The bowels were opened on the second day by an ox-gall enema The patient was out of bed on the twelfth day, and left the hospital on March 24

PROLAPSE OF RECTUM, BLOODLESS RESECTION

DR IRVING S HAYNES presented an Italian boy, ten years old, who was operated on March 19, 1908, for a prolapse of the rectum which had existed for seven years At each defecation, about an inch of the rectum protruded There was slight bleeding The prolapse could be easily replaced and caused him no pain The bowels were regular, and there was no history of constipation

Upon examination, the sphincter was found relaxed, and the anus dilated and patulous There was a superficial fissure in the anterior border of the anus, no ulceration of the mucous membrane The rectum was cleansed and packed The prolapsed section of the bowel was easily drawn outside of the anus for a distance of about three inches, and its base, half an inch from the anus, was ligated by overlapping but not interlocking ligatures passed by a round needle For this purpose, No 2 ten-day chromic gut was employed The distal portion of the prolapse was excised to within a quarter of an inch of the ligature lines, and the cut edges whipped over with a button-hole stitch of Pagenstecher thread On withdrawing the rectal tampon, the suture line immediately retracted above the anus

A plug of gauze, three-quarters of an inch in diameter, with a quarter-inch rubber tube for a core, and covered externally by rubber tissue was fastened in place, and extended a short distance above the line of resection

The boy made no complaint of pain or discomfort after the operation His bowels moved spontaneously on the fourth day and expelled the plug, which was not replaced At no time was there any bleeding When he left the hospital, on March 27, there was a slight induration along the line of resection, but no contraction whatever As to size, the rectum seemed perfectly normal

PARTIAL GASTRECTOMY FOR UNUSUALLY SITUATED
CANCER, WITHOUT OBSTRUCTION

DR GEORGE WOOLSEY presented a man, 66 years old, who was admitted to Bellevue Hospital on February 6, 1908. There was no history of pain after eating until two years ago when he began to complain of pain commencing about one hour after the ingestion of food. For the past year this pain had been constant, sharp and stabbing in character, and worse after eating. The appetite had not been lost. He had only vomited once or twice and there was no history of hæmatemesis. The patient had lost about 50 pounds in weight during the past two years.

Upon examination, the patient was found to be much emaciated, with a pale, yellowish complexion. His arteries were thickened, the pulse weak and intermittent. There was a systolic murmur near the episternal notch. The abdomen showed a smooth mass, about the size of an adult fist, to the right and a little above the umbilicus. It was slightly movable in all directions, and moved somewhat with respiration. It was tender on pressure, and tympanitic on percussion. An examination of the urine showed albumin, but was otherwise negative. The blood contained 45 per cent of hæmoglobin, with 15,000 white cells.

Operation, February 13, 1908. A vertical incision was made over the mass, which was found to be adherent to the parietal peritoneum. Upon freeing these adhesions the mass slipped upward and toward the median line, and on extending the incision upward it was found to be a tumor of the pyloric end of the stomach and to be further adherent to the transverse colon. These were separated, and the mass was removed after closing the duodenum with three rows of sutures. A posterior gastro-enterostomy was then done with the Murphy button.

Five days after the operation bile and duodenal contents began to escape through the wound. In spite of that fact, the remaining fistula gradually closed spontaneously, and it was now absolutely closed. The Murphy button was passed on the twenty-first day. The tumor was pronounced by the pathologist to be a carcinoma of the pyloric end of the stomach which had formed on the base of an old ulcer.

He has gained much in weight, color and general condition. There were few or no lymph-nodes enlarged.

URETERAL CALCULUS (TWO CASES), IMPROVED METHOD OF APPROACH

DR CHARLES L GIBSON presented two cases to demonstrate an improved method of approach for calculi situated in the lower portion of the ureter

The first patient was a man 62 years old whose symptoms dated back ten years. A calculus, weighing 270 grains, and located just at the brim of the pelvis was removed, and the ureter sutured in two layers. The wound was closed without drainage and healed by primary union within two weeks. Time of operation, 35 minutes.

The second patient was a man, 32 years old, whose symptoms dated back five years. A calculus, the size of a flageolet bean, was removed from the ureter. The ureter was sutured in two layers, and the wound closed without drainage. The patient was in bed ten days and left the hospital on the twelfth day after the operation.

The incision employed in both of these cases, Dr Gibson said, was planned to give a maximum amount of room and exposure of the lesser pelvis, entirely extraperitoneal, and to damage as little as possible the muscular layers, and to be made in intersecting planes. The superficial portion of the incision was practically the same as that devised by Stimson and Pfannenstiel, *e g*, an incision was made through the skin, aponeurosis of the external oblique, partly through the aponeurosis of the internal oblique and partly across its muscular layer, beginning at the mid-line, a finger's breadth above the pubis, carried parallel to Poupart's ligament, and then vertically upward to or even beyond the anterior superior spine. The upper flap was then retracted well upward. The fascia of the transversalis was then divided just as it emerged from under the rectus, and parallel to it. With the patient in the Trendelenburg position the peritoneum was easily pushed upward, and the rectus muscle, which was much mobilized by the preceding incisions, was retracted well away. The room and view obtained by this method allowed of further extrapelvic manipulations being carried out with the greatest ease. In both cases the ureter was readily freed from its bed, and lifted on the finger to the level of the skin wound, permitting of its incision and careful suture with absolute precision.

DR SAMUEL ALEXANDER said he had been present at both the operations reported by Dr Gibson, and could testify to what had been said regarding the method of approaching the ureter that had been described. The incision gave one control of the ureter throughout its entire length, especially its lower portion. The operation was comparatively bloodless, and the only difficult feature of it was the securing of the ureter in place in order to open it. This was overcome by passing a retractor underneath the ureter, drawing it into view, and then it could be manipulated with great ease. The speaker said he considered the operation described by Dr Gibson as a distinct and valuable advance in the field of ureteral surgery.

EXCISION OF KNEE

DR ROYAL WHITMAN presented a woman, 21 years old who for a period of about six years had suffered from a rather severe form of tuberculosis of one knee-joint. She entered the Hospital for Ruptured and Crippled in December, 1907, where the knee was resected by Dr Whitman. Three months after the operation the woman was able to resume her occupation as cook.

The removal of necrosed tissue from the tibia left two rather large excavations which had not in any way interfered with solid union.

OPERATIVE TREATMENT OF COXA VARA

DR ROYAL WHITMAN presented a boy, 10 years old, who was operated on in August, 1907, for coxa vara of five years' duration. To remedy the condition, Dr Whitman did the following operation, which he had now employed in these cases for many years. A wedge of bone was removed from the base of the trochanter, with its apex directly facing the trochanter minor. The size of the wedge to be removed could be accurately determined by means of an X-ray picture. The bone was not absolutely divided as the cartilaginous trochanter minor remained, and there was therefore no danger of the fragments overlapping. The wedge was closed by gently abducting the limb, the neck being fixed by contact with the upper border of the acetabulum, and in this position of abduction a plaster spica bandage was applied which remained until union had taken place.

By this method, Dr Whitman said, the full range of abduction was restored and functional cure was assured.

FRACTURE OF THE NECK OF THE FEMUR

DR ROYAL WHITMAN presented a man, about 40 years of age, who four months ago fell, sustaining an injury to the right hip. He was taken to a hospital, and after remaining there for a few days, was sent home. He suffered a good deal of pain in the region of the injured hip, and after a few weeks applied for treatment at another hospital, where a spica bandage was applied with the limb in the line of the body.

Four months had now elapsed since the accident. Examination showed that although union of the fracture had apparently occurred, yet the limb was adducted and flexed. In this case, Dr Whitman said, the deformity should have been reduced at once under an anæsthetic, the limb put up in full abduction and fixed by a plaster spica bandage. In that event a functional cure might have been anticipated in place of the disability illustrated by the patient which could be remedied only by operation.

FRACTURE OF THE PELVIS, RUPTURE AND LACERATION OF THE URETHRA

DR SAMUEL ALEXANDER presented a man, 21 years old, who was admitted to Bellevue Hospital on March 4, 1908. On the evening of his admission a heavily laden wagon which he was driving was overturned and he fell under one of the wheels, which struck him upon the outer rim of the ilium and rested upon him, pinning him to the ground. He was not extricated until the wagon was lifted and he was then brought to the hospital by ambulance. He was at first admitted to the general surgical service, and examined by the house surgeon, who failed to recognize the nature of his injury. On the following morning it was found that he had retention of urine. An attempt was made to pass a catheter, and two or three ounces of blood was drawn, the catheter not entering the bladder. He was then transferred to Dr Alexander's service.

Upon examination, the patient lay in the prone dorsal position, with the left hip flexed. Any attempt to move the hip caused great pain in the left groin. There was some ecchymosis over the crest of the ilium, and marked ecchymosis in the perineum, but no swelling.

By rectal examination a fracture of the left pelvic ramus was discovered. The fracture was oblique, and the outer frag-

ment was displaced downwards. The abdomen was tympanitic, but there was no tenderness, and no signs of extravasation of urine.

A silk coudé catheter, No. 16 F, passed without much difficulty into the bladder, the urine drawn was perfectly clear.

Operation—A perineal section was made, using the catheter as a guide. Upon introducing the finger, after opening the membranous urethra, the sharp end of the outer fragment of bone could be felt on the right side of the urethra. The latter had been cut through, and the wall, especially upon the left side, was lacerated. The upper end of the divided urethra had retracted for about $\frac{1}{2}$ inch.

A metal perineal tube was put in place, the fracture was reduced, and the opening over the bone was plugged by a strip of iodoform gauze. The pelvis was strapped anteriorly with broad strips of adhesive plaster.

The patient was put in bed with shoulders slightly raised, and a circular rubber cushion under the buttock. Syphon drainage was established.

The tube and packing remained in place continuously and without interruption of the drainage for 8 days. The patient was kept in bed for four weeks. The perineal wound healed kindly, and with no complications. The bowels were moved by enema, and each movement was supervised to prevent soiling of the wound. At the end of four weeks dilatation of the urethra was begun by sounds. The patient was now well, the urethra admits No. 26 F without difficulty and urine was voided normally and in a good stream.

ENCYSTED HYDROCELE OF THE CORD (INGUINAL PORTION), RESEMBLING OMENTAL HERNIA

DR. SAMUEL ALEXANDER presented a man, 20 years old, who was admitted to Bellevue Hospital on February 10, 1908, for a swelling in the right inguinal region. About one year ago the patient noticed a lump in the right groin which he says was about the size of an English walnut. He thought that at first this could be reduced by pressure, but for several months it has been impossible to reduce it, and he thinks that it is growing larger. Two weeks before admission he began to have sudden sharp shooting pains, especially at night after work. The swelling is painful when he coughs.

Upon examination, there is an oval tumor about the size of a small egg. This is adherent to the cord, and is situated within the inguinal canal. The swelling is tense and painless. Upon coughing there is slight impulse to the hand placed over the tumor, but no impulse to the finger passed through the external ring.

Diagnosis made of an encysted hydrocele of the cord. Operation, February 12, 1908. The inguinal canal opened as in Bassini's operation.

The tumor did not communicate with the abdominal cavity. There was no hernia. The tumor consisted of a sac lined with serous membrane, with a long diverticulum extending upward. The wall of the sac was thickened. It contained six drachms of clear hydrocele fluid.

The wound healed *per priam* and the patient was discharged March 3.

EPITHELIOMA OF PENIS, PARTIAL AMPUTATION OF PENIS AND LYMPH-NODES

DR SAMUEL ALEXANDER presented a man, 54 years of age, who was admitted to Bellevue Hospital December 5, 1907. He denied any venereal disease, but had been operated upon for an abscess in the groin twelve years ago. During November, 1906, he noticed a small nodule upon the glans penis, slightly ulcerated. He went to a dispensary, where a diagnosis of syphilitic chancre was made, and he was treated by injections of the salicylate of mercury. This treatment was continued for several months without causing any improvement. The growth has never been painful. There is no family history of cancer.

Upon examination, a nodule, slightly ulcerated and fungating at the edges was found upon the glans penis, the nodule was hard, and involved about one-half the entire thickness of the glans.

A section of this nodule was removed and examined by Dr Ewing, of the Cornell University Medical College, who pronounced it an "epithelioma, the growth of which seemed to be slow." The inguinal lymph-nodes were enlarged and hard.

Operation, December 11. About one-half the penis was removed by a circular amputation, the urethra being cut $\frac{3}{4}$ inch longer than the stump. The floor of this part of the urethra was split longitudinally, and the edges united to the skin and the sheath of the corpora cavernosa by sutures, the edges of the

skin were likewise sutured to the outer sheath of the corpora. The inguinal lymph-nodes were removed *en masse* from both sides. The patient was regularly catheterized for three days.

On January 21 the patient had a chill and rise in temperature to 104°, and developed erysipelas in the left inguinal wound, which had nearly healed. This delayed his convalescence and necessitated an incision of the left thigh. He did not leave the hospital until February 20.

A pathological examination of the inguinal glands showed no evidence of metastasis.

EPITHELIOMA OF PENIS, COMPLETE AMPUTATION OF EXTERNAL GENITALS AND INGUINAL LYMPH-NODES

DR SAMUEL ALEXANDER presented a man, 47 years old, who was admitted to Bellevue Hospital February 25, 1908. He denied all history of venereal disease. No family history of cancer. Six months before admission to the hospital he fell, striking the penis and scrotum upon a beam. No pain or swelling nor urinary disability followed. He had a congenital phimosis, and had never been able to retract the prepuce. Four months before admission he noticed a swelling in the right groin which was painful, but this partly subsided. Two months later the swelling recurred, and about the same time his penis began to swell and there was a discharge from within the cavity of the prepuce. He then began to have difficulty in urination, owing to obstruction at the meatus. The penis and the swelling in the inguinal region continued to enlarge, and the obstruction to urination became more marked. Upon examination, the penis was found greatly enlarged, measuring 3 inches in circumference, it was distorted, being curved upon itself to the right side. There was a profuse discharge of thin pus from the prepuce. The entire glans penis and the inner side of the prepuce were fungoid in appearance, the external meatus was reduced to the size of a fine needle.

The inguinal glands were enlarged upon both sides, the skin was reddened over these regions, and there was deep fluctuation upon the right side.

On February 27 a part of the prepuce and of the growth was removed for pathological examination, and was pronounced by Dr. Norris, pathologist to Bellevue Hospital, to be a very rapidly growing epithelioma.

On March 4, the inguinal nodes upon both sides were removed, and a complete amputation of the external genitals was performed, the urethra being transplanted to the perineum. The lymph-nodes were found diseased, and there were numerous metastatic deposits upon both sides. The wounds in the groin were left open, the remaining wound was sutured. The latter healed primarily, and the patient was discharged April 8. He passes a full stream of urine through the urethra, and has gained greatly in general health since the operation.

DR CHARLES L. GIBSON said the question of the time of operation was very important in connection with cancer of the penis. The speaker said he could recall patients who were alive and free from signs of recurrence ten years after operation. He did not believe that removal of the inguinal glands added much to the security of these cases, because there was just as much chance that the deep-seated glands were involved. The secret of success in dealing with malignant disease in this location, as elsewhere, was to get hold of the cases early.

DR ALEXANDER, in reply to a question, said the removal of the testes in these cases added much to the convenience of the patient. If they were permitted to remain, they interfered with urination. In some cases where he left the testes, he had split the scrotum in the median line, and then sewn up the incisions, thus making two complete sacs, which could be separated during the act of urination. It was usually preferable, however, to do a complete castration.

In early cases, where a partial amputation sufficed, it was not a good plan to take out the inguinal glands unless they were involved. He recalled one case where the operation was done nine years ago, without removing the inguinal glands, and the patient was still alive and well. In another case the recurrence was in the perineum, and not in the inguinal glands.

OPERATION FOR OLD INJURY OF THE FOREARM, INVOLVING THE FLEXOR TENDONS, MEDIAN AND ULNAR NERVES

DR WILLIAM A. DOWNES presented a man, 19 years old, who sustained an injury to the forearm 4 years ago, involving the flexor muscles and both nerves. As a result of this, the fingers of the right hand became absolutely fixed in a position of extreme flexion and the seat of trophic ulcers.

The patient was admitted to the General Memorial Hospital eighteen months ago, and the flexor muscles were exposed through an incision extending from the elbow to the wrist. This showed that these muscles in the middle third were represented by a cicatricial scar, no muscular tissue whatsoever remaining. The ulnar and median nerves were exposed, their upper and lower ends, which were separated in both cases over 2 inches, united by plastic operation, and the flexor tendons were lengthened by a tendon-splitting operation. The tendons were then wrapped in Cargyle membrane to prevent the formation of adhesions. There were evidences of some regeneration of the nerves since the operation and flexion had been gained to about one-half normal. The case was shown as evidence that much good could be accomplished in these cases of long standing contracture following trauma.

VOLKMANN'S ISCHÆMIC PARALYSIS

DR ALFRED S TAYLOR read a paper with the above title, for which see page 394. In connection with his paper, Dr Taylor showed a case illustrating the condition described.

DR JOHN F ERDMANN said that about two months ago he saw a case of this form of paralysis in a seventeen-year-old boy who came here from the South. He had sustained a fracture of both bones of the left forearm several months before, and this had resulted in ischæmic paralysis, with trophic changes in the area of the median nerve, with ulceration of the fingers at the terminal phalanges in the area supplied by the median, and profound trophic changes of the nails. He gave a history of tight bandaging with wooden splints for a period of seven days following the accident. Electrical examination made by Dr Joseph Collins showed that the paralysis of the nerve was complete. An incision was made down the middle portion of the forearm, exposing a marked muscle and fascia infiltration. The median nerve was exposed, and about its middle portion in the forearm a constriction was found, due to the imbedding of the nerve in this infiltrate. This constriction was about two inches long, and the nerve was diminished fully one-half its size above and below the point of constriction. The interosseous nerve was also exposed and found to be compressed. In spite of the fact that a very light dressing was applied after the operation the tissues

rapidly became blue-black and cold. It was necessary to simply lay the forearm in a trough splint, without exercising any pressure whatever. Subsequent to the operation, the patient being under observation for three weeks only, a marked improvement was observed, the ulceration of the fingers and nails rapidly healed, and the color and vascular supply and the local temperature were very much improved. A certain degree of extension had been gained. A report by letter to-day shows that the patient has been considerably improved, but that union of his fracture had not yet taken place. No excision of bone, with a view of shortening the forearm and thereby lengthening the tendons, was done.

DR JOSEPH A. BLAKE said he did not think this condition of ischæmic paralysis was so very uncommon. He could recall three such cases, one of them very recent. In one case, where he cut down upon the nerves, he found a condition of fatty degeneration of the muscles, which had not yet reached the fibrous stage. In the case he saw recently, the deformity and contraction were characteristic. Before considering shortening the bone in these cases, Dr. Blake said, he would suggest the use of massage, electricity and passive motion for a considerable period in order that the ultimate amount of contraction would be reached, thus obviating a relapse.

DR TAYLOR, in closing, said that in recent cases, like the one mentioned by Dr. Blake, where no nerve changes had occurred, experience had shown that conservative treatment in the way of passive motion, massage and electricity accomplished practically nothing. In these cases, a Frenchman named Martin had recently suggested the use of a splint attached to the fingers by means of rubber bands, so that constant and moderate extension could be thus exerted. Two weeks ago, at a meeting of the Pediatric Section of the Academy of Medicine, Dr. Reginald H. Sayre showed a case of this kind in which he had used an orthopædic splint, by means of which the degree of extension could be regulated and gradually increased. In that case and also in Martin's the contracture appeared after seven weeks, so that both were probably comparatively mild cases with only partial cicatrization of the muscles. In both cases there was very marked improvement. This treatment gives no relief to damaged nerves.

Stated Meeting, April 22, 1908

The President, DR JOSEPH A BLAKE, in the Chair

RESECTION OF TUBERCULOUS ELBOW

DR JOHN A HARTWELL presented a bricklayer, 53 years old, who was admitted to Lincoln Hospital on March 9, 1905. In April, 1904, he first began to suffer from evidence of a tuberculous infection in the left elbow-joint. He paid no attention to this, and continued to work almost uninterruptedly for 11 months. He then applied for admission at the hospital. Examination showed a typical advanced condition of tuberculosis of all of the structures composing the elbow-joint. There were discharging sinuses leading into it which had opened spontaneously. The muscles of the forearm were infiltrated with tubercular material as far as the middle third. Operation was performed a few days later, a typical resection of the joint being done through an externodorsal incision. All the joint structures were removed, the humerus being sawed through at the epicondylar level, the ulna just below the coronoid, and the radius through its neck. This was done subperiosteally in each case, the expansion of the triceps and the insertion of the biceps being carefully preserved, as well as the origin of the muscles arising from the condyles. The tubercular sinuses in the forearm were thoroughly opened and scraped. A dressing of iodoform paraffin plug was used, and the arm put up in the extended position. Convalescence was very slow, numerous tubercular abscesses having to be opened. The joint was moved from one position to another, so as to allow the best possible drainage, at the same time endeavoring to keep the bones in close apposition. Complete healing of the sinuses did not take place for more than a year. During the past two years the patient has had increased power and usefulness in the limb, and he has gained about 30 pounds in weight. Examination and X-ray (Fig 1) at the present time show that there is no apparent true joint formation, the condition being a mild degree of flail-joint. He has, however, considerable power, both in flexion and extension, he has absolutely no pain in the joint, and is able to use it for light work. A flexion splint has been worn part of the time to prevent lateral movements, but he seems to have more comfort without it. The case is shown as one of a very

FIG 1



Condition of elbow joint four years after resection for tuberculous

fair functional result, in spite of the loss of a considerable amount of the bony structures, and the very advanced involvement of the soft tissues at the time of operation. The functional value of the muscles arising above the external condyle is well preserved, and these serve a much useful purpose in the movements he enjoys. His general health at the time of operating and the local disease were of such a nature that amputation was seriously considered, and the convalescence was so slow that subsequently it presented itself as the only means of cure.

DR WILLY MEYER said that the Kocher incision gave very free access to the elbow joint, and the final functional result of this method of resection, on account of the preservation of the triceps tendon and part of the olecranon, was usually excellent. Dr Meyer said he was strongly in favor of doing these operations without the use of the Esmarch bandage, and he recalled two instances where paralysis lasting several months and seriously interfering with the after-treatment followed the application of the bandage. In tuberculous cases where sinuses persisted, he thought the hyperæmic treatment would prove very serviceable.

OLD FRACTURE OF PATELLA LENGTHENING OF QUADRICEPS

DR HARTWELL presented a negro, 42 years old, a truckman, who was admitted to the Lincoln Hospital on February 5, 1908. The history he gave was that about two months previously he had fallen from a truck, striking against the street curbing, and receiving, probably by direct violence, a fracture of the left patella. Excepting for a bandage about the knee, he received no treatment whatever. He remained in bed for a time, and then resumed his work as a truckman. He was able to walk on a level surface with very little trouble, but was unable to go up stairs or extend his knee when any weight was upon it. He is unable to raise his heel from the bed when lying in a dorsal position.

There is a transverse fracture of the patella, with a separation of $3\frac{1}{2}$ inches between the fragments, which can be reduced to about 3 inches by firm traction. There is considerable outgrowth about the fragments, so that each fragment measures approximately 2 inches in its vertical diameter, the right patella having a vertical diameter of 3 inches.

Operation was performed on February 8, 1908, as follows

The patient was placed in a dorsal position, and a vertical incision about 6 inches long was made over the fragments, exposing the muscle and tendon above. The fibrous union between the fragments, which was very much stretched and thin, was cut away, and the joint exposed and irrigated. The aponeurosis on each side was stretched, but as it contained very heavy fibrous bands, it was cut, and about 1 inch resected on each side of the patella. The fragments were now $3\frac{1}{2}$ inches apart, but could be forcibly reduced to $1\frac{1}{4}$ inch. A thin layer was sawed from the fractured borders of the patella to procure fresh surfaces for apposition. An M-shaped incision was then made into the quadriceps tendon and muscles, the outer legs beginning on the two borders of the tendon and running upward and inward toward the midline, the inner legs running from these and converging to a point directly above the patella, and about 1 inch from it (length of each leg about 3 inches), and carried to a depth of about two-thirds of the thickness of the muscle and tendon. Traction now brought the fractured edges of the patella into good apposition, with a comparatively small amount of tension. Two holes were now drilled into each fragment, and a square suture of very heavy silver wire put in and twisted on the anterior surface of the upper fragment. The aponeurosis just outside of the patella was overlapped and sutured with three stitches of heavy kangaroo tendon, thus bringing the fragments in perfect apposition. The remaining parts of the aponeurosis were overlapped and sutured with chromic gut No. 2, doubled. The apices of the incision in the tendon were united with the apices of the muscle, thus lengthening the vasti about 2 inches, and the parts sewed together with chromic gut No. 2, doubled. A counter opening was then made well back on the outer surface of the knee-joint, through which a large cigarette drain was passed. The skin was sutured with silk, and a sterile dressing applied, with a circular plaster splint encasing the whole of the lower extremity, with a window cut exposing the original incision and drainage wound. A small rubber tissue drain was placed in the lower angle of the skin incision. The patient was returned to the ward in good condition.

The wound healed *per primam* excepting at the exit of the drain, which healed in the course of ten days by granulation. There was no rise of temperature at any time. On the second day the patient got out of bed and walked to the bathroom,

FIG 2



Old widely separated fracture of the patella after tendon lengthing and wire suture

without apparent harm. With this exception he was kept in bed for five weeks. The first dressing was done on the fifth day, and the drains removed. On the tenth day slight passive movements of the patella were begun, the two fragments being firmly grasped and moved together. This was repeated each day for about three weeks, the amount of motion being increased gradually. After about five weeks the patient was encouraged to lightly contract the quadriceps muscle, so as to exert traction on the patella, the extremity still being encased in plaster. The splint was left off at night in the sixth week, and passive and active motion gradually begun. At the end of seven weeks the patient began to walk without a splint, but was cautioned against throwing any weight on the knee in a flexed position. At the present time (ten weeks after operation), he has a range of motion of about 45 degrees, both passively and actively. He walks without a limp, but complains of pain on long standing. This is probably due to the pressure of the wire suture against the condyles, and it may be that a subsequent operation may be necessary for the removal of the wire. Palpation of the patella shows strong fibrous union between the fragments, with no apparent separation on flexion of the joint. The X-ray plates, however (Fig 2), show that there is a tendency to such separation, and that the wire suture is probably still bearing a considerable strain, though there is no evidence that it has cut through the patella to any extent. The quadriceps tendon and muscles, apparently, are functioning normally.

BILATERAL NEPHROTOMY FOR NEPHROLITHIASIS

DR JOHN A. HARTWELL presented a man, 46 years old, a clerk, who was admitted to Lincoln Hospital on January 30, 1907. He had an attack of gonorrhœa 20 years ago, without sequelæ. Otherwise, aside from his present history, he had always enjoyed good health. In 1905 he had an attack which suggested a left renal calculus. After that he was operated on at a hospital in another city a left nephropexy being done, apparently under the belief that his trouble was a movable kidney, with a Dietl's crisis. He had no further attack on the left side. About ten days prior to admission to Lincoln Hospital he received a blow from a blunt object over the right abdomen in the lower lateral quadrant. The blow was severe enough to knock him down but did not

prevent his continuing at work. The day following, however, he had considerable pain in the region of the kidney, and tenderness over the right side of the abdomen, with distention and rigidity. This continued rather severely until his admission to the hospital. Inspiration was especially painful. He was running a temperature from 100 to 103, with accelerated pulse. The leucocyte count showed 20,000. Examination showed the whole abdomen rigid, more marked over the appendix and right hypochondriac, where pressure was very painful. The condition was diagnosed as a possible appendicitis, but more probably as a perinephritic inflammation. There were a few râles over the lower right chest, suggesting also a pleurisy. He was kept under observation for about three weeks. During the first week the symptoms continued unchanged, and he had several chills. Then they all subsided, and he was discharged from the hospital. He continued, however, to have more or less constant pain in the region of the right kidney and was re-admitted to the hospital on March 13th. Examination at this time showed the same condition as before, but to a much less degree, and he did not have any fever. A cystoscopic examination showed no abnormalities in the ureteral orifices. The ureters were not catheterized because this procedure was, for some reason, exceedingly painful, and offered special difficulties. X-ray plates at that time showed no abnormality in the right urinary tract, but gave a shadow in the line of the left ureter. As he had had no symptoms referable to this side other than the attack three years ago, and as all his present symptoms were referable to the right kidney region, and in view of the recent injury, it was decided to explore that organ. Accordingly, operation was performed on March 20th, a right nephrotomy being done through a vertical incision. The tissues overlying the kidney were found slightly contused, particularly about the fatty capsule. The kidney was slightly more adherent than normal, and the capsule seemed somewhat thickened. A longitudinal incision was made through the kidney substance into the pelvis of the kidney just posterior to the convex border. Evidence of an old pyelitis was found in the shape of some necrotic tissue at the apices of two or three of the pyramids. It was cut away, and was reported by Dr. Ewing to be necrotic tissue. A small drain was put down into the kidney, and the wound sutured in layers. Healing by primary union took place.

There was no urinary nor purulent discharge from the sinus. About six weeks later, however, he passed two stones *per urethra*, with no antecedent symptoms in the ureteral tracts. With this exception, the subsequent history was uneventful, and he remained well until the following December. He then began to have pain over the left kidney, with tenderness and some fever. He was ill for a few days and then recovered, but still had some pain in the left kidney region. He was re-admitted to Lincoln Hospital on March 3, 1908, having been more or less invalided most of the time since the previous December. Examination indicated a low grade of sepsis, with dry skin and tongue, and considerable emaciation. Temperature, 98, pulse, 120, respiration, 28. Blood examination, 12,000 white cells, 81 per cent polynuclears. Urinary examination showed a few red blood and pus cells, otherwise normal in quantity and composition. Aside from pain along the kidney and left ureter, there were no subjective symptoms. Neither kidney could be palpated, but considerable tenderness and rigidity was present over the site of the left side. No cystoscopic examination was made. Operation, March 11th. The patient was placed in the right lateral prone position and a vertical incision was made in the left lumbar region, exposing the fatty capsule. The kidney was very adherent by its convex surface to the lumbar wall as the result of the former nephrospexy. The adhesions were broken away with the fingers, and the kidney delivered through the wound. It was found divided into two parts, the upper quarter of the kidney being almost entirely separated by a deep depression running around the organ. The pedicle of the kidney was grasped in the fingers, and a vertical incision made through the convex border. The upper pole of the kidney was found to be a mere shell, with a necrotic lining showing a calyx connected with the ureter. Two or three spots of necrosis in the kidney substance were removed. A catheter was passed through the ureter into the bladder without meeting with any obstruction. The necrotic shell of the upper pole was cut away, and the kidney sutured and returned to its bed. A rubber tissue drain was put through the kidney substance into the pelvis of the organ. The muscles and skin were then sutured, and two cigarette drains inserted down to the kidney. A dry sterile dressing was applied, and the patient returned to the ward in good condition and a few grave negative

bacilli cultures from the kidney pelvis showed a growth of staphylococci-streptococci. There was some urinary leakage along the track of the drain for the first five days, this then subsided, and the drains were entirely removed. The sinus was practically closed by the tenth day. He continued, however, to have some pain along the site of the left ureter. On the twelfth day this pain was severe, and there was an elevation of temperature (the only fever that he had), following which the sinus opened and discharged a little purulent urine. Two days later he passed a small rough calculus *per urethram*. Convalescence was uninterrupted from this time on, and he left the hospital at the end of four weeks free from symptoms, and with the wound entirely healed.

The case is shown as illustrating the difficulty of locating small stones in the urinary tract and because of the interest attaching to the rather varied symptoms which may result therefrom.

Dr Hartwell said that he was indebted to Dr Osgood for taking the radiographs and making the cystoscopic examinations in these cases.

PERFORATING GASTRIC ULCER

DR CHARLES L GIBSON presented a man, 27 years old, who had always enjoyed good health and had suffered from no digestive disturbances until the 19th of November, 1907, when he first complained of a vague discomfort in the stomach. In the middle of the afternoon he suddenly experienced an agonizing pain in the epigastrium. He also complained of severe pain in the left supraclavicular fossa, but this was temporary. The abdomen was of board-like rigidity.

The case was regarded as one of perforating gastric ulcer and the patient was transferred to the hospital immediately and operated on within three hours after the onset of the pain. A perforation of the stomach wall was found near its pyloric end. This was closed by a double purse-string suture, and pelvic drainage maintained for 48 hours. The man made an uneventful recovery.

Dr Gibson also presented a second patient, a truck driver, 23 years old, whose history was not unlike that of the preceding case. After moderate epigastric distress he had a violent, sudden attack of pain in the region of the stomach. He was taken to the

hospital and operated on five hours after the onset of his acute pain. He gave no previous history of gastric disturbance, and had never vomited in his life.

A fairly large perforation was found on the anterior wall of the stomach, close to the pyloric end. It was easily closed with a purse-string suture, with temporary drainage of the pelvis.

In neither of these cases, Dr. Gibson said, did he resort to a gastro-enterostomy with a permanent cure in view. He doubted whether it was desirable to complicate acute cases of this kind by such a procedure. Many of these patients after proper treatment, showed a condition of the gastric contents which was practically normal, and he did not know whether a gastro-enterostomy would eventually become necessary or not.

PERFORATING DUODENAL ULCER

DR. WILLIAM A. DOWNES presented a boy, 18 years old, who about a year ago had a sudden, sharp attack of pain in the epigastrium, lasting half an hour. He did not vomit, and although he felt weak, he was able to continue with his work. Since that time he has had periods of discomfort in the epigastric region, which he attributed to indigestion. He had occasional attacks of vomiting during the past six months, but had never vomited blood nor had his stools contained evidences of blood so far as he knew.

About noon, on Saturday, March 21, 1908, while working on a scaffold with both arms extended over his head, he was seized with a violent attack of cramp-like pain in the region of the umbilicus. He did not vomit, but felt weak, and his body was covered with perspiration. After lying down for half an hour, the pain passed off, and he was able to ride home, a distance of about a mile, on a car. His supper consisted of egg, bread and butter, and the following morning he felt as well as usual with the exception of some tenderness in the right side of the abdomen. Sunday evening he consulted his physician, who made a diagnosis of appendicitis and advised operation. On Tuesday, March 24th, three days after his attack of pain, he walked to the hospital a distance of half a mile. His temperature on admission was 99.5, pulse, 80. There was moderate rigidity of the right rectus, and indefinite tenderness in the same region. No jaundice. The bowels were open. A diagnosis of subacute appendicitis was

made, an operation advised and set for the following day. An examination of the urine made on Wednesday morning showed a trace of bile. Otherwise negative. At 1 30 that afternoon, half an hour before the time set for the operation, while lying quietly in bed, he was seized with an attack of pain similar to the one he had had on the preceding Saturday. When Dr. Downes first saw him, half an hour later, the pain had lessened somewhat, but he was lying with his knees drawn up, the body covered with cold perspiration, and complaining of intense pain in the entire right side. There was board-like rigidity of the abdomen. The diagnosis of appendicitis was then doubted. The abdomen was examined under ether with negative results.

Operation. An intermuscular incision was made over the appendix, and upon opening the peritoneum a slight amount of bile-tinged serum escaped. The appendix was readily drawn up, and its peritoneal coat was found congested. The appendix was removed and opened, but there was no evidence of disease in the mucous membrane. The abdominal wound was thereupon closed and a second incision was made over the gall-bladder. Upon opening the peritoneum at this site, there was a gush of bile-colored serum. The gall-bladder, which presented in the wound, was moderately distended but apparently normal in appearance, with the exception of slight congestion of its peritoneal coat. It contained no calculi. Thinking that possibly the trouble lay in the ducts, the finger was passed along the cystic duct into the foramen of Winslow, and an indurated mass was immediately felt between the finger and the abdominal wall. This was drawn into the wound, and proved to be the duodenum. It presented an open ulcer, three-eighths of an inch in diameter, situated on its anterior surface, about an inch and three-quarters from the pylorus. There was a free escape of bile and mucus, but no particles of food. There were no fibrinous adhesions at any point. The edges of the ulcer were smooth, and there was no bleeding. There was moderate induration and oedema extending from three-quarters to one inch on all sides.

The perforation was closed by two purse-string sutures of silk. The lumen of the gut did not seem to be diminished sufficiently to warrant doing a gastro-enterorrhaphy. The bile-stained mucus was sponged away, but the abdomen was not washed out. A cigarette drain was inserted which was removed on the second

day Food was taken by the mouth on the third day. Convalescence was uneventful.

DR. HOWARD LILIENTHAL called attention to an article by Dr E A Codman which appeared in the *Boston Medical and Surgical Journal* (April 16th) In this paper the author suggested that many of these ulcerations of the duodenum and also of the stomach might be due to the chemical changes caused by compression of the duodenum by the mesentery, and he explained the beneficial results of gastro-enterostomy on the ground that it relieved the distention caused by this constriction. As a possible remedy for this condition, Dr. Lilienthal suggested transplanting a part of the constricted duodenum to the right, so that it would turn before the fold of the mesentery crossed it Unless the anatomical causes of stagnation in the duodenum and gastric hyperacidity could be relieved, the end-results of operation for gastric ulcer were not very promising, and the speaker said he knew of one case where three such operations were necessary for recurrent ulcer

DR WILLY MEYER said that during the past winter he had operated on a man, 56 years old, with a gastric perforation near the pylorus In this, as well as in a second case he had in mind, the stomach wall was so much infiltrated that a double row of Lembert sutures was necessary, the usual purse-string suture being out of the question The case seen last winter was operated on 22 hours after perforation, and promptly recovered and left the hospital at the end of the third week About one month later he developed ileus due to adhesions, and subsequently his symptoms pointed to a second perforation at the original site The abdomen was again opened, and an abscess drained The point of leakage could not be found, and the patient died In that case, Dr Meyer said, he felt confident that if at the time of the original operation he had done a rapid gastro-enterostomy, the future course of events might have been avoided

In a second case which he operated on a few days ago the symptoms were apparently so mild that the patient was able to walk into the hospital The stomach wall was so much infiltrated that Lembert sutures were necessary In that case he did an immediate gastro-enterostomy

DR ELLSWORTH ELIOT, JR, said he had operated on quite

a number of cases of duodenal ulcer with very satisfactory results, and yet no gastro-enterostomy was done. On the other hand, he was inclined to agree with Dr Meyer that in some of these cases, a secondary gastro-enterostomy might prove necessary, but as to the advisability of doing it at the time of the primary operation, that was an open question.

Dr Eliot said that a review of his old cases of gastric and duodenal ulcer showed that in a great majority of the cases the perforation occurred without premonitory symptoms.

DR CHARLES H. PECK said he agreed essentially with Dr Eliot's views. He had had eight cases of perforating gastric and duodenal ulcer, and in none of them had he done a gastro-enterostomy at the time of the primary operation. Six of his cases recovered, and of the five of these that he had been able to follow none had shown any symptoms that demanded a secondary gastro-enterostomy. In several of these cases, the perforation was near the pylorus, and in more than one he feared that sufficient narrowing of the pylorus would occur to require a gastro-enterostomy. Personally, Dr Peck said, he believed that the gastro-enterostomy should not be done as a routine measure at the time of the primary operation, but only as a secondary operation if the symptoms warranted it.

DR JOSEPH A. BLAKE said the question of whether a gastro-enterostomy should or should not be done depended entirely on the degree of obstruction to the pylorus. Of course, in deciding whether a gastro-enterostomy should be done at once or subsequently, one had to be guided largely by the condition of the patient at the time. Many of these patients are in very good condition. In a case which he operated on recently there was complete stenosis of the pylorus after closure of the ulcer, and a gastro-enterostomy was immediately done. Gastro-enterostomy should not be a routine procedure in these cases, the indications for it being the same as in ulcer of the stomach without perforation. Dr Blake said he did not think it was necessary to resort to drainage in these cases, they got along perfectly well without it.

CARCINOMA OF THE MALE BREAST

CHARLES L. GIBSON presented a man, 62 years old, whose past history was unimportant. Until about four months before coming under observation, when he first noticed a lump in the

right breast, which grew slowly When Dr Gibson first saw the patient, the growth had attained the size of an adult palm, and was adherent to the chest wall A pathological examination showed it to be a typical carcinoma, having apparently begun in the gland tissue There were no enlarged glands in the axilla The mass was excised and the defect remaining was closed with skin grafts

Dr Gibson said frequency of carcinoma of the breast in men, is estimated within widely varying limits, some observers placing it as high as one in men to twenty in women, others as one in a hundred

DR H LILIENTHAL said that in two cases of carcinoma of the male breast coming under his observation, one was attributed by the patient to the more or less constant irritation of the nipple caused by his suspender buckle

DR WILLIAM B COLEY said he had seen two cases of carcinoma of the male breast One began as a case of Paget's disease of the nipple, while in the other the tumor was within the breast

DR JOHN F ERDMANN said he had seen four cases of carcinoma of the male breast, one recently, and three that were already on record Two began about the nipple in the other two he could not say where they originated

INOPERABLE ROUND-CELLED SARCOMA OF THE BACK,
WITH METASTATIC TUMORS INVOLVING A LARGE
PORTION OF THE LOWER JAW—ENTIRE DIS-
APPEARANCE UNDER TWO AND A HALF
MONTHS' TREATMENT WITH THE
MIXED TOXINS

DR WILLIAM B COLEY presented a man, 27 years of age, who had always been in good health previously, good family history, no history of injury, first noticed a tumor in the lower lumbar region in September, 1907 This grew with great rapidity and had reached the size of two fists in the latter part of September, when it was operated upon at the City Hospital by Dr J C Biddle A portion of the tumor was sent to the Jefferson Medical College Hospital, and the examination was made by Dr John Funke, the pathologist to the hospital, who pronounced it large round-celled sarcoma The tumor was apparently of fascial or muscular origin, it did not involve the bone, but extended down to and around the spinal nerves It recurred immediately and

reached its original size, when a second operation was performed in the latter part of October by Dr Biddle. At about this time a metastatic tumor developed in the lower jaw. The patient was sent by Dr C B Dreher, of Tamaqua, Pa., for advice on November 16, 1907. Examination at this time showed a large, unhealed wound in the lumbar and sacral region, 6x8 in in extent, the unhealed portion being the shape of an excavation nearly an inch deeper than the surrounding surface. The bottom of the wound showed evidence of recurrence. The lower jaw showed a metastatic tumor beginning one inch to the left of the symphysis on the right side and extending to the angle of the jaw on the left, occupying the entire thickness of the jaw. The patient had lost more than 40 pounds in weight, he was cachectic in appearance, and unable to walk without help. Although the chances of success from the toxins were exceedingly slight, they were sufficient to make it wise to give the method a trial. One quarter minim injected into the gluteal region was the initial dose, the latter was gradually increased until a temperature reaction of 102-103° was produced. Under these systemic injections, the tumor of the jaw began to diminish in size and became very much softer. When it had become almost fluctuating, an incision was made over the most protuberant part, and it was found so highly vascular that it was difficult to control the bleeding. The patient's general condition began to improve after the first 2-3 weeks' treatment. The tumor in the jaw became gradually less and less vascular, and after six weeks' treatment a portion of it was curetted out through the exploratory incision, and examined microscopically. It was found to be a round-celled sarcoma, of the same type as the primary disease. By this time the improvement in his general condition became much more rapid, and he gained 16 pounds in a single month. The wound healed rapidly, and all evidence of tumor growth, both in the back and jaw, had disappeared at the end of 2½ months' treatment, with 47 injections. The patient left the hospital on February 8, 1908, and the treatment was continued once a week by his family physician, after his return home, only small doses being given, not sufficient to produce any marked reaction. The largest dose in this case was 8 minims. All the injections, with the exception of five of the filtered toxins made into the jaw, were systemic, being given in the gluteal region and thigh. At the present time, about six

months after the beginning of the treatment, or three months after the tumors disappeared, the patient is in perfect health. He has resumed his work, and has gained 49 pounds in weight. There is not the slightest evidence of a tumor remaining, either in the jaw or in the back.

SUPPURATIVE ARTHRITIS OF THE KNEE

DR GEORGE PECK, in the absence of Dr George E Brewer, presented a negro boy, who was admitted to the service of Dr Brewer at Roosevelt Hospital for a penetrating gun-shot wound of the left knee-joint. The case was first treated by exploration and drainage, but it was subsequently found that the bullet had injured the internal condyle of the femur, and septic symptoms developed. Five days after the injury Dr Brewer exposed the knee-joint, and put the leg up in a flexed position, in this posture it was drained for six weeks, then a typical resection was performed, and the leg replaced in complete extension, the method followed being that of Mayo. The operation was done on the 10th of last March. The patient made a good recovery, he still wore a splint.

UNDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA

DR JOHN B WALKER presented a boy of 19 years, who came under treatment for an undescended right testis associated with an inguinal hernia on the same side. Upon operation the testis was found lying above the internal ring in peritoneal cavity. It was brought down into the scrotum, where it has since remained. It is unusual to find the testis in the abdominal cavity and requires more than usual dexterity to free it so that it remains in the scrotum.

REPOSITION OF ABDOMINAL UNDESCENDED TESTIS IN SCROTUM, FOLLOWED BY NECROSIS

DR CLARENCE A McWILLIAMS presented a man, 22 years old, who since his third year had had a left inguinal hernia, and absence of the testis on that side. He applied for operation for his hernia, and upon opening the inguinal canal the missing testis was found just inside the internal ring. It was about half the size of a normal testis. The vas descended beside the testis to

the external ring, and then curved upwards again to the testis. On attempting to bring the testis down it was necessary to divide the pampiniform plexus, and in doing this the artery of the vas was accidentally cut. Following this there was no difficulty in getting the testis into the scrotum, and then the hernial operation was completed.

About a week after the operation there was fluctuation in the scrotum, and an incision showed that the testis had necrosed in its new position. The hernial wound remained perfectly clean. The necrosis of the testis, Dr. McWilliams said, would probably not have occurred if the artery of the vas had not been divided.

THE TREATMENT OF UNDESCENDED OR MALDESCENDED TESTIS, ASSOCIATED WITH INGUINAL HERNIA

DR. WILLIAM B. COLEY read a paper with the above title for which see page 321.

Dr. Coley also showed a number of patients illustrating his subject. The histories of these cases were contained in his paper.

DR. CHARLES N. DOWD, referring to the technic of the operation, said that nine years ago, at a meeting of this Society (*ANNALS OF SURGERY*, '99, vol. xxx, p. 338), he showed two cases where he had sutured the cord at the external ring, passing small chromic gut sutures through the fibrous tissue of the cord and through the external oblique aponeurosis. Since then he had followed the same procedure in many cases and he was convinced that it was of distinct advantage. It is difficult to speak positively in regard to the advantages of any particular technic, because the cases themselves differ so widely. The speaker said that in a recent case of double undescended testes with conditions the same on both sides he had on one side stitched the cord to the margin of the external ring and also stitched the tunica albuginea to the scrotum, while on the other side he omitted to do this. The result was much better on the side in which the stitches had been taken.

DR. JOHN B. WALKER said that in most of the cases he had seen, the difficulty in bringing down the testis was due to the shortness of the sac. On opening the sac in the inguinal canal, he was able to bring the cord down to the external ring, where it turned back on itself. On attempting to bring down the testis, very little progress was made, but on dividing the sac, the testis

was immediately released. The speaker said he never had a case in which he was unable to bring the testis down by this method, and he had never seen atrophy result.

DR BLAKE said that if the operator took advantage of the Fowler method of dividing the deep transversalis fascia from the external ring to the spine of the pubes, an inch or more could be gained in the transplantation of the cord. It afforded a more direct route in bringing the cord down to the scrotum. Another point in the technic was to make use of the external oblique and the intercolumnar fascia to crowd down the testis.

DR ERDMANN, commenting on the statement contained in Dr Coley's paper that strangulated inguinal hernia of the superficial variety associated with undescended testis was rare, said he had operated upon four or five such cases.

DR COLEY, replying to Dr Erdmann, said he had seen but a single case of strangulated omental hernia associated with undescended testis, and they had never seen a case of strangulated hernia at the Hospital for Ruptured and Crippled, associated with undescended testis.

The point of suturing the cord at the external ring, which Dr Dowd had suggested a number of years ago, had more recently been claimed by a French writer, who had resorted to it in 15 cases with very satisfactory results. Dr Coley said that personally he had never tried it, but he thought the idea was a very good one. The same was true of the point in technic suggested by Dr Blake to assist in bringing down the cord.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, Held Monday, April 6, 1908

INFANTILE PARALYSIS TREATED BY TENDON TRANSPLANTATION AND NERVE ANASTOMOSIS

DR ASTLEY P C ASHHURST presented several patients from the Orthopædic Hospital, from the services of Dr G G Davis and Dr R H Harte, to whom he was indebted for permission to operate and to report the operations

CASE I—Paralytic Varus, Transplantation of Tibialis Anticus into the base of the fifth metatarsal bone

Alfred C came to Dr Harte's clinic, April 20, 1905, when 11 years of age. In December, 1901, when 7 years old, he had had a disease in which both legs and arms were paralyzed, and which confined him to bed for five months. The boy was unable to walk alone for a year afterwards. His family physician has informed Dr Ashhurst that the diagnosis of cerebrospinal meningitis was confirmed by the board of health. When seen at the Orthopædic Hospital the chief complaint was that the left ankle turned very easily, and that the boy was constantly falling, there was quite a noticeable limp. The peroneal muscles were paralyzed, and there was a mild degree of varus, the foot turning easily until the sole was parallel with inner surface of the tibia. He had been wearing a brace for several years. A new brace was ordered which held the foot in perfect position. The patient wore this brace for nearly two years longer, and it was then decided, as no further improvement had occurred, to resort to operation. As a preliminary the foot was stretched manually, and put up in plaster in an over corrected (valgus) position, on February 18, 1907. On April 4, 1907, Dr Ashhurst transplanted the tendon of the tibialis anticus to the base of the fifth metatarsal bone. The cast was changed at the end of three weeks.

and a new one applied for five weeks longer. At this time, eight weeks after the operation, the transplanted tendon was firmly attached at its new insertion, and by its contraction flexed the foot into a very slight valgus position. A shoe was ordered, with its sole raised on the outer side, so as to maintain over-correction for some time longer. Two months later it was noted that all the motions of the foot were normal, the transplanted tibialis anticus everting and flexing the foot well, while the power of inversion was retained by the tibialis posticus. The boy now walks without any limp, never falls from turning of the ankle, and except for the scars of operation, it is difficult to tell which was the paralyzed foot.

CASE 2—*Paralytic Valgus, ankle-drop, and knee-drop*
Transplantation of peroneus brevis to the base of the first metatarsal bone, and transplantation of the gracilis and semi-tendinosus to the upper border of the patella

Frank W., entered the service of Dr G G Davis, February 26, 1907, when 11½ years of age. He had had infantile palsy at the age of 10 months, and had been under the care of Dr T G Morton, who ordered a brace and had the patient treated with electricity. Later at the University Hospital, an operation (arthrodesis?) was done on the ankle, and a brace was ordered. When the patient came to the Orthopædic Hospital he could hardly walk at all without his brace, having to put his hand on his left knee at every step to keep it from collapsing like the blade of a pocket knife into the handle, as there was absolutely no power of holding the knee extended. Besides the paralysis of the quadriceps extensor femoris, the following muscles of the foot were paralyzed: tibialis anticus, extensor longus hallucis, extensor longus digitorum, tibialis posticus, and flexor longus hallucis, the calf muscles were weak, but contracted feebly. The only muscles which contracted well were the peronei, and the flexor longus digitorum. On April 17, 1907, Dr Ashhurst transplanted the peroneus brevis to the base of the first metatarsal bone, to replace as far as possible the paralyzed tibialis anticus, at the same time the gracilis and the semitendinosus were transplanted into the upper margin of the patella. The plaster cast was removed eight weeks later, and, after the patient's old brace had been fitted, another cast was applied while alterations were being made in the brace. It was found possible to dispense with

the apparatus above the knee, as the transplanted hamstring muscles effectually prevented the collapse of the knee in walking, although voluntary extension is not yet possible. He never falls down now, and the transplanted peroneus muscle can slightly invert the foot and correct the extreme valgus deformity present before the operation. The boy, however, still wears the old brace to keep his foot in good position, and it seems probable that arthrodesis will have to be resorted to before the brace can be entirely discarded. There is also paralysis of the erector spinæ group of muscles, and the limp, due partly to the shortening of the whole lower extremity, is aggravated by the extreme lordosis.¹

CASE 3—*Paralytic calcaneus, with varus and foot-drop. Transplantation of the anterior tibial nerve into the musculocutaneous, and of the peroneus longus muscle into the insertion of the tendo Achillis.*

Fred J. S. entered Dr. Davis's service February 26, 1907, when 7 years of age. He had had infantile palsy at the age of 2 years, affecting both legs. The left leg largely recovered its functions, only a slight cavus deformity remaining. The right foot showed moderate calcaneus, with varus and foot-drop. The peroneal muscles contracted well, but there was paralysis of the following muscles: tibialis anticus, extensor longus hallucis, extensor longus digitorum, flexor longus digitorum, flexor longus hallucis, and the muscles of the calf. The condition of the tibialis posticus was doubtful, but it was certainly very weak. The only voluntary motion possible was a very feeble extension (plantar flexion) and abduction of the foot by contraction of the peroneal group. There was no power of raising the heel, and if there had not also been foot-drop, the boy would doubtless have walked on his heel with his toes in the air, as in pure paralytic calcaneus. As the entire distribution of the anterior tibial nerve, embracing the tibialis anticus, the extensor longus hallucis, and the extensor longus digitorum, was paralyzed, while the entire distribution of the musculocutaneous nerve was intact, the case seemed a suitable one in which to attempt to divert some of the nerve impulses from the latter into the anterior tibial nerve. It was determined at the same time to transplant

¹ On June 3, 1908, Dr. Ashhurst did arthrodesis of the ankle-joint and of the subastragalar joint in this patient.

the peroneus longus into the calcaneum, so as to overcome as much as possible the calcaneus, which was the most disabling deformity. On June 1, 1907, Dr Ashhurst isolated the musculocutaneous nerve by dissecting through the peroneus longus muscle, just below the head of the fibula. After finding the musculocutaneous nerve on the surface of the fibula, the anterior tibial nerve was easily located just to its mesial side, before it had perforated the septum between the peroneus longus and the extensor longus digitorum. Two sutures of very fine silk, threaded in ophthalmic needles, were then passed through the sheath of the anterior tibial nerve, one on either side, and after this had been done, the nerve was divided with a tenotome above this point, just below its recurrent articular branch. Then a longitudinal slit was made with a tenotome in the musculocutaneous nerve, and by means of the sutures previously placed in the musculocutaneous nerve the latter was drawn into the slit in the anterior tibial nerve, and sutured to the sheath of the anterior tibial nerve. Two other sutures were placed above and below the first two, through the sheaths only, to act as guys, and relieve any possible tension on those first placed. The deep fascia was closed with interrupted silk sutures, and the skin with chromic gut sutures. Then the peroneus longus tendon was divided at the base of the fifth metatarsal bone, and transplanted into the periosteum at the insertion of the tendo Achillis. The time of the operation was 40 minutes. A plaster cast was applied, extending to the middle of the thigh. After six weeks a new cast, extending only to below the knee, was applied, and worn for several weeks longer. At no time was there any evidence of injury to the musculocutaneous nerve, into which the paralyzed nerve had been transplanted. Since August, 1907, the patient has been wearing his old brace. There has been absolutely no result from the nerve anastomosis, the muscles supplied by the anterior tibial nerve having no more power than before the operation. The transplanted peroneus longus muscle has restored a slight degree of power of raising the heel, and has at all events prevented a recurrence of the calcaneus deformity. Subastragalar arthrodesis will probably be required later, as the foot is still rather flail-like.

CASE 4—*Paralytic valgus, transplantation of peroneus longus and brevis into base of first metatarsal bone*

This case was reported at the last meeting of the Academy by Dr G G Davis, in connection with his operation of transplantation of the tensor fasciæ femoris for outward rotation of the lower extremity from infantile palsy. The operations were done October 22, 1907. The transplanted peroneal muscles act well, and overcome almost entirely the previous valgus. An ordinary shoe is worn, and the slight limp is due chiefly to the shortness of the paralyzed leg.

CASE 5—*Paralytic valgus, transplantation of peroneus brevis and extensor longus hallucis into base of first metatarsal bone*

Pasquelino R, aged 7 years, had infantile palsy when four years old, and had never received any treatment for the resulting deformity. He entered Dr Harte's service at the Orthopædic Hospital October, 1907, with marked valgus of the right foot. The tibialis anticus was paralyzed, but the extensor longus hallucis and extensor longus digitorum contracted well, and the peroneal muscles also appeared to be normal. The boy walked on the inner surface of his foot, with a very marked limp. On December 10, 1907, Dr Ashhurst transplanted the peroneus brevis into the base of the first metatarsal bone, and as it did not appear to be as strong when seen at operation as it had been thought to be before, the tendon of the extensor longus hallucis was divided on the dorsum of the foot, and after suturing its distal end to the neighboring tendon of the extensor longus digitorum, its proximal end was also sutured into the base of the first metatarsal bone, at the point of insertion of the tibialis anticus, thus supplementing the paralyzed tibialis anticus by both the peroneus brevis and the extensor longus hallucis. The plaster cast was removed two months later. The transplanted muscles now contract satisfactorily, and while there is no over-correction, the valgus deformity has been overcome, and the arch of the foot restored. The patient wears a shoe with its sole raised on the inner side, and is able to walk very well without any kind of apparatus, and with a scarcely noticeable limp.

CASE 6—*Paralytic valgus, transplantation of peroneus longus into base of first metatarsal bone, and transplantation of distal end of tibialis anticus into extensor communis digitorum*

William M, entered Dr Harte's service at the Orthopædic Hospital, May 4, 1905, at the age of 7 years. He had had

FIG. 1



Case I Position of transplanted tibialis anticus outlined on the skin

FIG 2



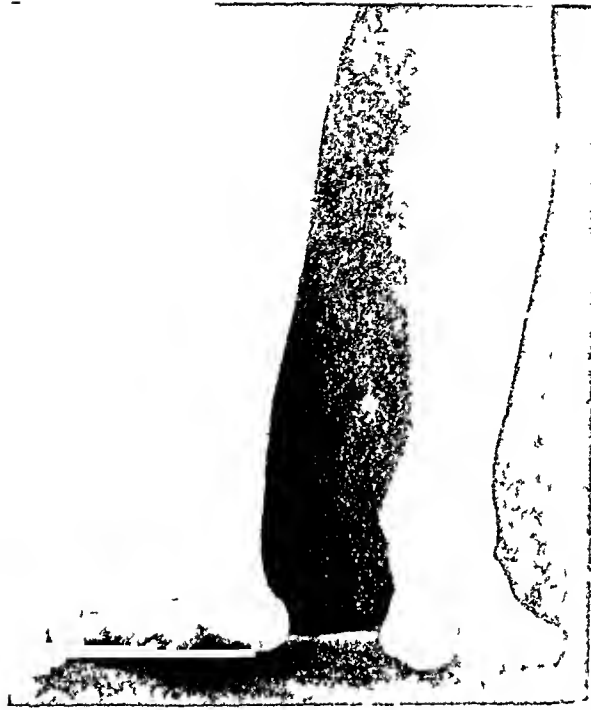
Case II Paralytic valgus before operation

FIG 3



Case II Paralytic valgus after operation

FIG 4



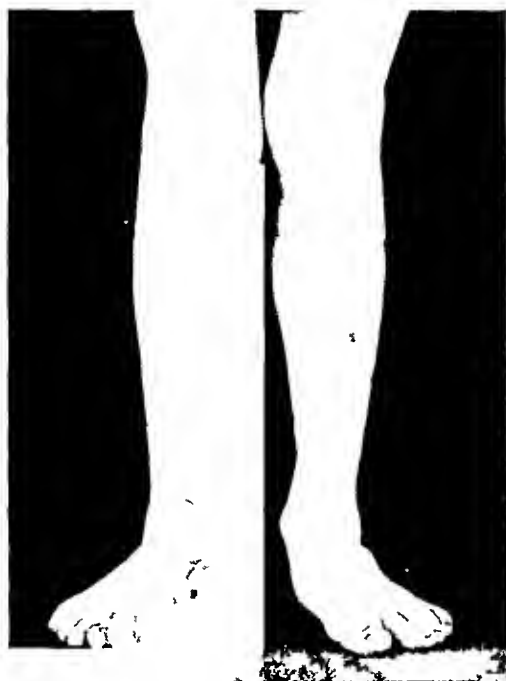
Case III Paralytic calcaneus with varus and foot-drop Before operation

FIG 5



Case III After operation The incisions for the nerve anastomosis and for the tendon transplantation have been on line 1 on the shin

FIG 6



Case V Paralytic valgus Before operation

FIG 7



Case V After operation

FIG 8



Case VI Paralytic valgus Before operation

FIG 9



Case VI Paralytic valgus After operation

infantile palsy at the age of 2 years, which had left him with valgus and slight ankle-drop of the right foot. The tibialis anticus, tibialis posticus, and extensor longus hallucis were paralyzed, the extensor longus digitorum contracted well, and the peroneal muscles appeared to be normal. A brace was ordered, but the patient did not return to the Orthopædic Hospital for nearly two years, when it was found that an operation of some kind (apparently shortening of the tibialis anticus) had been done by a homœopathic doctor. The boy was now wearing a brace, and his foot was if possible in a more deformed condition than at his first visit. Without the brace there was marked toe-drop, and he walked on the inner side of his foot, his sole turning outwards. He was admitted to the ward of the Orthopædic Hospital in October, 1907, and his foot was forcibly stretched under an anæsthetic on October 24, November 7, and November 30. The deformity having now been entirely overcome, Dr Ashhurst operated December 31, 1907. The peroneus longus was transplanted into the base of the first metatarsal bone, and as it did not appear to be very strong, and as the extensor longus hallucis was entirely paralyzed, the tendon of the tibialis anticus was divided above the annular ligament, and its distal end was sutured under tension to the tendon of the extensor longus digitorum, which was normal, thus pulling the foot into the varus position. The plaster cast was removed two months later, and the result was found to be more satisfactory than had been anticipated. By flexion of the ankle through the extensor longus digitorum the distal end of the tibialis anticus is also pulled upon, so that the foot is no longer everted, but can be somewhat inverted also. The patient wears a shoe with its sole raised on the inner side, to maintain the over-corrected position.

DR JOHN H JOPSON discussed the result in the second case shown by Dr Ashhurst, in which he transplanted the gracilis and semitendinosus into the upper border of the patella. The patient is greatly improved, there being additional strength given to the knee. But the lack of power of voluntary extension would seem to support the views of Lange, who advises that in transplanting the ham-string tendons the entire group be transplanted rather than a couple of muscles, as in this way there is a much

greater chance of achieving early alteration of function of the muscle from a flexor to an extensor

DR G G DAVIS referred to the question raised by Dr. Jopson as to the utility of transplanting certain parts of a group of muscles. Dr. Davis said that in practically all of the cases, even where there was a transplantation of but a single muscle, the result was satisfactory, that he has had cases in which the transplantation of the semitendinosus has been sufficient, and although it might not give the power of extension which would be derived from the transplantation of the entire group of flexor muscles, it was nevertheless sufficient to steady the knee, rendering it possible to dispense with the use of any apparatus. The main object of the operation is to give sufficient power of extension to prevent the knee from suddenly flexing as the patient walks and he believes that this result can be obtained in some cases by the transplantation of a single muscle.

DR JOHN H JOPSON said that he had not meant to criticize the operation which had been done in the case discussed, as the result was an excellent one, but thought the case referred to was a good example of the contention raised by Lange. When tendon transplantation was first brought forward it was claimed that one could alter at will the function of the muscle as easily as we could change its insertion. This claim has been found somewhat exaggerated, and as a result there had been for a time a revulsion of feeling in regard to the operation.

DR WILLIAM L RODMAN said that three weeks ago he had anastomosed the musculospiral for wrist-drop, doing practically the same operation as Dr. Ashhurst, bringing the distal end of the nerve over to the median, by transfixing the brachialis anticus muscle and anastomosing it with the median and musculocutaneous. At the present time there seems already return of sensation in the skin over the hand and fingers.

DR ASHHURST, in closing, said, in reply to inquiry, that he did not know how long one should expect to wait for a nerve to regenerate, ten months had elapsed in the present case. He said that he had seen statements that even one or two years should be allowed to elapse before hope of a good result should be abandoned, and said that if in that length of time his patient should be fortunate enough to obtain return of power, he would take pleasure in showing the boy again.

TWENTY-FIVE HUNDRED CASES OF GAS-ETHER ANÆSTHESIA WITHOUT COMPLICATION

DR J J A VAN KAATHOVEN (by invitation) read a paper with the above title, for which see page 435

DR JOHN B ROBERTS thought the reader had brought out a point not always insisted upon, namely, that very little ether is needed after the patient once becomes etherized. Dr Roberts said that it would seem from his experience with the Resident Physicians who administer ether for him that they had never been taught the importance of this fact. They get the patient etherized for the surgeon and then continue to pour on as much ether as they did at the start. He thinks Dr Van Kaathoven has properly emphasized the need of plenty of ether to start with but very little afterwards, and the desirability of having the patient in such condition that he comes out of ether as soon as the operation is over. He is inclined to believe that what is called the "drop method" has been so talked of recently that many men are claiming to give ether by what they call the "drop method" when they are really pouring more ether on the inhaling apparatus than is done by those who know what is scientific administration of the anæsthetic. After all, it is not the "method" that is to give safety to the patient, but the experience and brains and attention of the administrator.

DR G G ROSS said that there were two things about serious operations which gave him an undue amount of alarm. The first is the junior resident who gives the ether and the other is the unsophisticated female who handles the gauze. He thinks that the danger does not lie so much in the ether as in the man who is giving it. In hospitals where they do not have teaching in connection with the other hospital work and therefore no teacher for that particular art, he thinks it would be wise to have an official anæsthetizer on the senior staff who would be responsible for the instruction of students or residents until they are fully qualified to give ether properly and safely.

DR G G DAVIS said that the use of nitrous oxide preceding ether anæsthesia is an old one although it seems to be coming into favor only now in this progressive country. It was commonly used in London over twenty-five years ago and he thinks a method which has taken so long to establish itself on an acceptable basis argues either that the public is very slow in recognizing

the utility of good things or else it is not worthy of recognition. The objections to the method are in the first place, that it requires more experienced anæsthetizers and it gives rise to very considerably more mucus, and the transition from nitrous oxide to ether is liable to be unsatisfactory, especially, Dr Davis believes, when the so-called "drop method" is used. We hear of eight to sixteen layers of gauze but personally Dr Davis has never liked gauze, thinking it inferior to a close meshed towel in efficiency. Time and time again he has had the anæsthetizer fail to anæsthetize the patient rapidly, simply on account of the amount of air which is inhaled. He believes in deliberately excluding air when it is desired to rapidly anæsthetize the patient.

As regards the advantages of nitrous oxide, Dr Davis was not prepared to admit with Dr Van Kaathoven, that it leaves the patient in better shape than a simple anæsthesia with ether. If ether is used alone and time is taken in its administration, he believes it is the safest anæsthetic agent, and if it is preceded by the morphia and atropine injections its results would be as good, as far as the after-effects go, as if preceded by nitrous oxide.

DR WILLIAM L. RODMAN said that he thought it had long ago been conceded that ether is best preceded by nitrous oxide. He also believes that chloroform can be preceded by nitrous oxide in the majority of instances. He was particularly glad to hear that one hundred students at the University had been allowed to administer the anæsthetic. He does not think it a broad position to say that a paid anæsthetist should be in every hospital, certainly not in teaching hospitals, for if the students are to be sent out without practical experience, how can they be expected to give an anæsthetic. Dr Rodman thinks that it is perfectly safe for students to give ether under competent instructors inasmuch as the danger signals are thrown out promptly and are easily recognized and met. During the past term every senior student at both the Woman's Medical College and the Medico-Chirurgical College has given an anæsthetic. He thinks that the giving of anæsthetics is one of the most important things to be taught students. Dr Rodman agrees with Dr Van Kaathoven that the drop method is the best. Also that if ether is not to be preceded by gas a most valuable adjuvant is talking to the patient, for he has literally seen patients almost talked to sleep. He is impressed with the fact that ether is not as safe

an anæsthetic as is generally thought, there is a great deal of pneumonia following it. He does not consider it safer than chloroform. He has given chloroform as often if not more frequently than ether and has never seen a death from it in his own practice, but he has had three deaths from ether. When a patient goes off the table after chloroform one can be easy about him, whereas it is the reverse with ether, they are apt to have suppression of urine, develop pneumonia or bronchitis. For these reasons Dr Rodman prefers giving chloroform in nephritis rather than ether. He thinks that in hospitals where it is practicable, ether should always be preceded by nitrous oxide, as he believes this will reduce the mortality rate from the administration of ether very materially.

DR CHARLES H FRAZIER does not believe surgeons connected with non-teaching hospitals realize how much they are handicapped in educational institutions where a greater part of the routine surgical work is carried on with students as etherizers and assistants. It is not fair to criticise a junior resident at the hospital because he is not at the time he enters upon his work a skilled anæsthetist. The fault lies with the organization of the clinic and the administrative officers of the hospital. To assign to a junior resident the responsible post of anæsthetizer is a practice worthy only of condemnation and fortunately long since abandoned by many hospitals.

DR OSCAR H ALLIS said that the discussion on this subject had helped him to understand why it was so hard to teach the young men who came to the Presbyterian Hospital the way in which to administer an anæsthetic, as they had administered it two or three times somewhere else and thought they knew it all. It seemed to make no difference to them that Dr Allis had had thirty-five or forty years of experience. Dr Allis said that operators often become impatient and hurry the anæsthetizer, for his part he never hurried the anæsthetizer, and always considered his duty as important as was his own as operator. He has sometimes seen the patient almost dead from an overdose of ether, and the anæsthetizer still pouring it on wholly oblivious to the patient's critical condition. He thinks that anæsthetizers are as a general rule too much interested in the work of the surgeon and not enough interested in their own important duties.

Dr Allis said that any one who knew anything about ether felt that he knew nothing, as the dangers and responsibilities change with each individual case. He thinks it would be a wise arrangement if each hospital had a well paid expert anæsthetizer.

DR JOHN H GIBBON emphasized one improvement which has been made in general anæsthesia, namely, reduction in the amount of ether which is given. Where gas or ethyl chloride is given first, and especially where these agents have been preceded by morphia and atropine, the patient can be fully anæsthetized in from three to four minutes. The morphia and atropine given twenty minutes or half an hour before the anæsthetic is started reduces the amount of ether necessary during the progress of the operation. By following out this plan the ether given the patient is reduced to the minimum, and the after-complications which result from ether are greatly reduced. Dr Gibbon wished to know in what number of the 100 cases which Dr Van Kaathoven stated had been anæsthetized by students, and in 81 per cent of which no subsequent nausea or vomiting had occurred, morphia and atropine had been given prior to the anæsthetic.

DR VAN KAATHOVEN, in replying to Dr Gibbon's question as to the number of patients who had morphia and atropine given beforehand in the series of 100 anæsthetized by students, said that he did not think over 20 per cent received this preliminary treatment, and that in at least fifty private cases there was the same percentage. He does not think the morphia renders the patient more prone to nausea. After the patient becomes conscious from the anæsthetic he often passes off into a comfortable sleep.

With reference to Dr Allis' remarks, Dr Van Kaathoven said that he realized the difficulty of impressing the student with the fact that just because he has a bottle in his hand there is no reason why he should always be pouring from it, and that it is only by keeping them to the other extreme that he is able to impress upon them the importance of not anæsthetizing too deeply. One never knows what is going to happen and it is therefore of the utmost importance to pay strict attention to the patient at all times.

ANNALS OF SURGERY

VOL XLVIII

OCTOBER, 1908

No 4

ORIGINAL MEMOIRS.

CANCER OF THE MOUTH AND TONGUE

BY J. COLLINS WARREN, M D,
OF BOSTON, MASS

THE anatomical and physiological conditions which are to be reckoned with in operations upon the mouth and tongue combine to make the problem of surgical interference in this region more complicated than in almost any other portion of the body. This becomes evident at once when we review the great variety of operations which have been developed for the radical cure of cancer. It has been the aim of the reporter to refer briefly to the modern methods adopted with this end in view, and to present such data as are suggestive of the lines along which the operation of the future is to be worked out, and the operative surgery for cancer in this region placed upon an equality with that designed for the treatment of cancer in other regions of the body. A brief statement is, therefore, presented of the recent studies of the lymphatic system of the tongue and mouth as viewed from a surgical standpoint, also a consideration of the conditions which have been thought to predispose to cancer, the evolution of the operative treatment and, finally, the results obtained by operation in the service of a general hospital.

* Read before the International Society of Surgeons, September 22, 1908

The statistical data on which this paper is based are derived from the study of 172 consecutive cases of cancer of the tongue and mouth which appear in the records of the Massachusetts General Hospital during the 15 years from 1890 to 1904, inclusive¹ Only cancers of the tongue and mucous surfaces of the mouth have been considered Sarcoma, cancer of the upper jaw arising in the antrum, adamantine epitheliomata, and other tumors originating in the dental membranes have been excluded, together with all cases in which pathological examination did not confirm the diagnosis, or recurrence and metastasis did not prove the diagnosis to be correct

ANATOMY

There have been no notable contributions to the existing knowledge of the gross anatomy of the muscles, blood-vessels, nerves and mucous membranes of the tongue and floor of the mouth, in recent years, but the lymphatic vessels and lymph-nodes of this region have been made the subject of special study by Poirier, Kuttner, Crile and others, particularly with a view to the relation between these structures and the operative surgery of cancer of this portion of the body A brief summary of the existing knowledge of these lymphatics may be made as follows

The lymphatic capillaries on the dorsum of the tongue form a delicate network in the anterior part of that organ, which becomes coarser toward the base, and surrounds the papillæ circumvallatæ at their posterior margin Along the borders of the tongue, this network gives off tree-like branches which constitute the origin of a series of lymph-trunks running to different groups of lymphatic glands There is a sharp line of separation between this system and that which drains

¹These cases have been collected and analyzed by Drs R B Greenough, C C Simmons and R M Green, by the consent of the Visiting Surgeons and with the assistance of the Administrative Department of the hospital, and the statistics will be published later in more detail No cases operated upon since 1904 have been included, in order that at least three years' time may have elapsed after every operation

the base of the tongue, and the space between it and the epiglottis, bounded laterally by the tonsils. The capillary lymphatics of this latter region have an entirely distinct point of fetal origin, the lymph from this region is collected into two large vessels on either side behind the tonsils, which pass through the muscles of the pharynx and empty into the superior deep cervical glands.

The lymphatic vessels given off from the border and under surfaces of the tongue are more numerous in front. One vessel is deserving of special notice, for it runs from the neighborhood of the frenum, forming a long loop along the outer border of the omohyoid muscle, and reaches the deep cervical glands low down in the neck, thus forming an almost direct route from the chin to the clavicle. The remainder of the lymphatic vessels from the border of the tongue pass through the submaxillary group of lymphatic glands, and empty into the largest of the superior deep cervical glands lying near the bifurcation of the common carotid. The lymph-trunks from the dorsum of the tongue follow in a general way the course of the lingual artery, but in the middle line some vessels run through one or two small glands between the geniohyoglossus muscles, and communicate, some with the superior and some with the inferior group of deep cervical glands.

The superficial lymphatics of the tonsils and upper portion of the pharynx communicate almost directly with the deep cervical glands, while the mucous membrane covering the cheek and the alveolar process of the upper jaw is drained more directly into the submaxillary group.

There may be said to be four groups of lymphatic glands which are of special interest to us surgically in connection with cancer of this portion of the body. These may be described as (1) the lingual group, (2) the submaxillary group, (3) the superior deep cervical group, and, (4) the inferior deep cervical group.

The *lingual group* is composed of glands lying on the mylohyoid muscle and between the geniohyoglossi, and occa-

sionally near the terminal portion of the lingual artery. The glands are in close relation with the group of muscles which form the diaphragm of the mouth, and are a part of the system which drains the tip and the anterior two-thirds of the dorsum of the tongue.

The *submaxillary group* is found principally in the digastric triangle in more or less intimate relation with the submaxillary salivary gland. The glands of this group are adherent to the capsule, or lie between its folds, and lymph-tissue is even said to exist inside the capsule of the salivary gland itself. Glands continuous with these, and forming part of this group, extend as far back as the parotid. The submaxillary group receives afferent vessels from the border of the tongue as far back as the fauces, from the middle section of the anterior half of the tongue, the under surface of the tip of the tongue and the floor of the mouth. Associated with this group is a small chain of glands in the neighborhood of the hyoid bone.

The *superior deep cervical group* is composed of glands lying on the sheath of the internal jugular vein and on the carotid artery. The largest and most important gland lies at the point of division of the common carotid, or somewhat higher, and receives a large number of afferent vessels coming from the mouth and tongue. This group of glands extends upwards as high as the base of the skull, and drains all parts of the mouth, tongue and fauces and the upper part of the pharynx. Anastomosing with this group is a small cluster of glands beneath the lower end of the parotid salivary gland, receiving vessels from the anterior surface of the palate, which has a lymph drainage separate from that of the rest of the mouth and pharynx.

The *inferior deep cervical* or supraclavicular glands are those below the point of crossing of the omohyoid muscle and the internal jugular vein, they reach down behind the clavicle and receive some branches directly from the tongue, both from the apex and the base. The terminal branches of this chain on the left side at least, empty directly into the jugular

and subclavian veins independent of the thoracic duct. This chain also drains the floor of the mouth in its anterior part. Both of the deep cervical groups are more or less covered by the sternomastoid muscle, and are adherent to the deep layers of its sheath.

From a study of the lymphatic systems of the mouth and neck, we have brought home to us very clearly certain anatomical explanations of clinical symptoms bearing upon the problem of surgical interference. The base of the tongue is, anatomically speaking, separate from the body of that organ. The lymphatic systems of these two areas are quite distinct, thus, it is clear that in a large number of cases of cancer of the anterior portion of the tongue, the part behind the papillæ circumvallatæ can be spared. Although it is claimed that a lymphatic injection mass can be forced into both halves of the tongue from a given point, it is still obvious that the communication is not a direct one. It is probable that the lymphatic anastomosis between the right and left halves of the tongue is not a free one, and although the stream, as in other forms of cancer, may readily be diverted from its direct course by inflammatory or cancerous blocking of the lymphatic trunks, yet in early cases we may well expect that cancer should be limited to one side of the median raphe. If this were not the case it would be difficult, indeed, to explain in so many cases the radical cure of early cancer of the tongue by removal of that half of the tongue containing the disease.

The lymphatic drainage of the floor of the mouth involves even wider areas than that of the tongue itself. All of the muscles in this region are studded with lymph-glands, and the salivary glands from the sublingual in front to the parotid behind, have lymphatic glands in intimate relation with them, if not actually included within their capsules. All of these lymphatics may be regarded as way-stations on the main line leading to the deep cervical glands of the superior or inferior group. The direct lymphatic communication between the anterior portion of the floor of the mouth and the deep cervical

glands of the inferior group, must always be borne in mind² Cancer of the tongue appears to involve the upper deep cervical glands primarily, whereas cancer of the floor of the mouth first attacks the submaxillary group (Wolfler) Cancer at the tip of the tongue, or of the floor of the mouth, near the frenum, passes first to the submental and sublingual group According to Butlin, the lymphatic glands may be involved within a few weeks of the origin of the primary disease, but, on the other hand, several months may elapse before glandular involvement occurs³

ETIOLOGY

When all is said, little is known with regard to the etiology of cancer of the tongue and mucous membranes of the mouth In this region more than most others, chronic irritation appears to be a contributing if not an exciting cause, and a number of different inflammatory conditions have been cited by different authorities as predisposing, or precancerous, conditions Leucoplakia, or leucoma, is a chronic disease which may remain for years unchanged In many cases, however, a tendency develops to induration, and even ulceration There is first an hypertrophy, and then an ingrowth into the parts below⁴ Chronic ulcers, cracks and fissures, with or without hypertrophy of the mucous membrane, the direct result of the mechanical irritation of the teeth (dental ulcer), undoubtedly

² The reporter recalls in this connection a case of cancer of the lip with involvement of the submental glands, which was followed shortly by involvement of the supraclavicular glands without intervening disease Among the hospital cases, also, there was one of carcinoma of the upper jaw, inoperable, in which a cancerous gland was removed from the axilla

³ There were 7 cases of cure of cancer of the tongue in the Massachusetts General Hospital series, in which no neck dissection whatever was done The duration of the tumor in these cases was from 2 to 24 months

⁴ In 159 cases of cancer of the tongue quoted by Von Bergmann, leucoplakia was seen in 34.6 per cent But, according to Butlin, in the greater number of cases, leucoplakia is not followed by cancerous degeneration

favor malignant growth. Inflammation of the gum due to chronic pyorrhœa, with constant discharge of pus from around dead roots and carious teeth, may give rise to thickening and breaking down of the epithelium, and the development of cancer of the mucous membrane of the alveolar process. Epithelioma may also arise from the periodontal membrane. Persistent glossitis may give rise to more or less permanent structural changes in the tongue and long-continued ulceration, which must always be regarded with suspicion.

The opinion is wide-spread that both syphilis and smoking are important etiological factors in cancer of the mouth. Thus, Poirier would call cancer of the tongue, "*cancer des fumeurs syphilitiques*," and cites in corroboration of this opinion 32 cases of cancer of the tongue, all of which were smokers, and 27 of which had syphilis. Fournier also attributes to syphilis an important rôle in the etiology of cancer of the tongue and mouth. In 100 cases of syphilis, he describes 14 cases of leucoplakia, and in 184 cases of buccal cancer, 155 had syphilis. On the other hand, Whitehead's figures do not seem to point in this direction, for of 104 cases cited by him a definite history of syphilis was obtained in only 7, 62 of these cases, however, were smokers, and in the majority of cases the cancer was on the side of the tongue which came in contact with the pipe. In our own series of cases, and in those of Meller, tobacco and syphilis appear to be of slight importance. Most of us will probably agree with Butlin that syphilis is an indirect rather than a direct cause, as tending to produce those conditions of the tongue which predispose to cancer.

Owing to its appalling danger, there are few diseases in which an early diagnosis is more essential than in cancer of the mouth. There is no question but that the public should be better instructed in the hygiene of the mouth and teeth, and taught the importance of seeking medical advice for any chronic lesion of this portion of the body. "The practitioner of dentistry cannot be too conscious of the power he possesses of preventing death from cancer, and of the awful responsibility he incurs for overlooking precancerous conditions, or

early malignant disease of the mouth (Roughton) " Butlin calls attention to the fatal tendency of the physician to treat early cancer as syphilis, or as some other less serious affection of the mouth " To give the patient ' a chance ' is, under such circumstances, to give the carcinoma a chance to form an irresistible hold, and to take away all hope of complete recovery from the patient "

PATHOLOGY

From the point of view of origin, there are two types of carcinoma of the mucous membranes of the mouth The first arises from the epidermic layer of the mucous membrane, and the second from the epithelial glands immediately beneath its surface Squamous-cell carcinoma, or epithelioma of the mucous membrane itself, is the prevailing type In 80 cases of cancer of the tongue at the Middlesex Hospital, 76 were of this variety It does not appear that cancer in other regions of the mouth differs materially from that seen in the tongue A case of so-called " Paget's disease " of the jaw has been reported by Smith, which doubtless represents an early stage of epithelioma Of squamous-cell carcinoma, two varieties are recognized,—basocellular and planocellular (spirocellular), or, as the French term them, " épithéliome tubulé " and " épithéliome lobulé," the former containing cells resembling those of the rete mucosum, and the latter containing the coarser type of squamous cells, with cell nests Poirier in 20 cases found 9 épithéliomes lobulés, 2 épithéliomes tubulés, and 9 cases of the two varieties combined

The situation and relative frequency of cancer in the different portions of the buccal mucous membrane may be appreciated by a consideration of the statistics of the Massachusetts General Hospital, 172 cases of cancer of the mouth showed the following distribution There were 98 cases of cancer of the tongue and floor of the mouth, 40 of cancer of the mucous membrane involving the lower jaw, 14 of the mucous membrane involving the upper jaw, 11 of the tonsil and soft palate, and 9 cases of the mucous membrane of the

cheek This relative frequency of cancer in these regions conforms closely to that of the 207 cases reported by Meller, and those of Boyd and Unwin, Morestin, Gurlt, and other writers

It is a well-established fact that malignant disease of the mouth spreads both by direct contiguity, and by extension to lymphatic glands In no other region of the body does growth by contiguity assume a greater importance, and in the majority of cases recurrence appears to be due to the failure of the surgeon to leave a sufficient margin of healthy tissue in the removal of the primary disease It has been stated that many of the glands removed at operation though palpably enlarged, did not show cancerous involvement on microscopic examination (Jacobson, 15 per cent) It would be rash, however, to act on the assumption that they were not involved to a certain extent, and that the microscopic examination had not failed to detect a few of the implanted cancer-cells

There has been much discussion as to whether the lymphatic vessels leading from the primary growth to the nearest lymphatic glands were not possible sources of recurrence in cases in which the two-stage operation is performed It has been held by some that epithelioma of the tongue, unlike cancer of other organs,—such as the breast,—extends not by continuous growth in the lymphatics (Handley), but by lymphatic emboli, and some of the advocates of the two-stage operation support this view The success of the two-stage operation in many cases would appear to justify this belief, but it cannot be said to have obtained general credence Boyd and Unwin are emphatic in stating that recurrence may occur from the failure to remove cancerous lymphatic vessels, and the advocates of the Kocher, Langenbeck, Crile, and other more radical operations, base their plan of operative treatment upon the belief that the whole lymph-bearing tissue,—vessels as well as glands,—should be removed in cancer of this region just as in any other portion of the body

Internal, or remote, metastases are apparently most unusual In 147 autopsies performed at the Middlesex Hospital

on cases of cancer of the tongue, the occurrence of internal metastasis was as follows liver, 8, lungs, 7, pleura, 4, suprarenal, 3, heart, 2, and other regions, 1 Crile found in a study of 4500 cases of cancer of the head and neck that internal metastasis occurred in less than 1 per cent We may safely conclude, therefore, that it is the local disease and the regional lymphatic metastasis which is the serious consideration of a surgical attack upon cancer of the mouth and tongue

DIAGNOSIS

Enough has been said about the so-called precancerous conditions of the tongue and buccal mucous membranes to indicate the importance of early diagnosis The symptoms actually pathognomonic of cancer develop only at a stage of the disease when operative interference can promise little, if any, hope of radical cure A large indurated ulcer extending from the side of the tongue across the floor of the mouth to the alveolar process and accompanied by enlarged lymph-glands of the submaxillary or deep cervical group permits of little doubt as to diagnosis, and still less as to the ultimate result It is the early and doubtful cases that require especially the surgeon's consideration

The indiscriminate use of specific treatment as a means of diagnosis should be thoroughly discouraged The therapeutic test is often fallacious, according to Hutchinson Iodide of potassium often improves an epithelioma and relieves pain, and hygiene of the mouth, with careful feeding, often helps to improve local conditions Antisyphilitic treatment should certainly not be continued for a sufficient length of time to allow any perceptible increase of the growth

In the very early and doubtful cases, an exploratory operation is the safest and most scientific solution of the problem of diagnosis This should not be attempted, however, until all the preparations have been made for performing the complete operation if it prove to be required For such an exploratory operation, if possible, the whole of the primary growth should be excised, in preference to the removal of a small

portion This tissue can be submitted to a pathologist, who should always be present at an operation of this character A "frozen section" can then be made and a positive diagnosis returned immediately The more material given the pathologist, the more accurate his diagnosis, and the less likelihood of spreading the disease by setting free living cancer-cells in the depths of the wound Removal of the surface of the growth by curetting can hardly be considered a sufficiently exact method for general use, and the results of punching out specimens for examination may lead to cancer extending along the exploratory tract, as was shown by Richardson in a case of cancer of the breast The disturbance of a primary lesion any considerable length of time before an operation is to be avoided if possible, and it is for this reason better to defer the exploration until the patient has been anæsthetized and prepared to undergo the radical operation, if it should be required

OPERATIVE TREATMENT

Operations for the radical cure of cancer of the tongue and mucous membranes of the mouth have been developed by different surgeons along several different lines We readily distinguish three main classes of operations for the removal of the primary tumor (1) the intrabuccal operation, (2) the approach beneath the jaw, and (3) operations involving the division or resection of the lower jaw For the removal of the lymphatic glands beneath the jaw and in the neck, a variety of operations are described, differing chiefly in the extent of the operative attack, and in the thoroughness with which the lymph-glands are removed Surgeons differ also with regard to the preliminary treatment of their patients and the technical details of the conduct of the operation

Preliminary Treatment—The reporter has long believed that a proper cleansing of the mouth by a dentist, with the removal or treatment of carious teeth, should precede any operation in the mouth It is not to be expected that the buccal cavity can be made an aseptic field of operation, but the number and variety of pathogenic bacteria which normally inhabit it,

can surely be diminished. The hypodermic injection of atropine, $\frac{1}{100}$ grain, one-half to one hour before operation, is of decided benefit in reducing the flow of mucus and promoting a quiet anæsthesia. The hypodermic injection of morphia, $\frac{1}{4}$ to $\frac{1}{6}$ grain, before operation, is also practised by many surgeons with the same purpose in view.

Anæsthesia—Ether is the anæsthetic most commonly employed for operations upon the tongue and mouth, although chloroform is used by a number of surgeons (Morestin, Eisen-drath, Kuster). In the Massachusetts General Hospital cases, ether has been used exclusively.

The position of the patient is influenced somewhat by the anæsthetic employed, and by the different methods of preventing the access of blood to the respiratory tract. The upright position in an operating chair, as used by some surgeons at the Massachusetts General Hospital, or in a rocking-chair, as advocated by Whitehead, offers certain advantages. In this position, the blood escapes freely from the mouth, but anæsthesia cannot be carried to its full extent, and coughing, and even vomiting, sometimes hamper the surgeon and perhaps may infect the wound. The lateral position, as recommended by Butlin, allows the blood to escape from the mouth freely, but does not offer the surgeon an unrestricted operating field. It is doubtful whether this position could be used except with the preliminary laryngotomy employed by Butlin. Poirier and other surgeons advise Rose's position for the intrabuccal operation, while Crile and a number of American surgeons have employed the semi-upright position, combined with bandaging of the extremities and intubation of the pharynx.

Some surgeons insist strongly upon the importance of ligature in the neck, by a preliminary incision, of the lingual or external carotid arteries in order to diminish hemorrhage, while others (Whitehead) consider this detail unnecessary. Crile advocates the use of temporary clamps upon the common or external carotids, on one or on both sides, and claims to obtain a practically bloodless field by this manœuvre. He states that he has clamped the carotid in 61 cases, without

either immediate or remote complications His method of diminishing venous hemorrhage is by the partially upright position

There has been much discussion upon the propriety of performing the intrabuccal and the neck operations in two stages The mortality of the combined operation as stated by Butlin in 13 cases, was 23 per cent as opposed to a 7 per cent mortality when the operation was done in two stages Associated with this question is the discussion of whether the lymphatic vessels are the site of continuous cancer growth, as held by some, or whether embolic infection of the lymph-glands occurs without intervening disease of the lymphatics Butlin, Crile, Whitehead and Jacobson advocate especially the two-stage operation, while Kocher, Von Bergmann, Poirier, Kuttner and Eisendrath perform the local operation and the neck dissection at one sitting The two-stage operation is designed to diminish shock and sepsis, and to lower the rate of mortality It entails, however, an added nervous strain, and is an ordeal many patients might be unwilling to undergo Its weakest point, however, is that it fails to remove the zone of lymph-bearing tissue behind the jaw It may be that the two-stage operation represents only a stage in the development of the operative surgery of cancer of the tongue, and that with greater resources and improved technic the mortality of the operation may be in time reduced, so that the whole radical operation can be safely performed at one sitting, and the disadvantages and dangers of delay avoided

The protection of the air-passages in operations about the mouth presents many difficulties The upright position of the patient may give sufficient protection without other aid, but that this is not invariable is shown by the other expedients which have been devised Butlin performs a preliminary laryngotomy and lays stress upon its advantage in favor of the prognosis of the operation The tube is withdrawn as soon as the operation is complete, the wound heals promptly, and leaves an almost imperceptible scar Jacobson also recommends laryngotomy, while the continental surgeons more commonly

employ tracheotomy Both of these procedures are supplemented by packing the pharynx with gauze above the tube to prevent leakage into the air-passages from above Crile has devised a method of intubation of the pharynx which appears to be satisfactory in the majority of cases, and has been widely adopted in America Two rubber tubes as large as can be drawn through the nares, are pushed down to the epiglottis, the tongue is drawn well forward, and gauze packing is introduced about the tubes into the pharynx, which should be previously cocaineized These tubes are connected by a Y tube with a glass funnel, and ether is administered by the drop method on a piece of gauze placed over the top of the funnel

To summarize these details of operative technic, it may be said that the upright or semi-upright position with intubation of the pharynx or tracheotomy are the methods most commonly employed for either intrabuccal or more radical operations, that the use of a clamp on the common carotid, or ligature of the external carotid is a wise precaution in undertaking the more extensive operations, and that the operation in two stages, allowing an interval of ten days to two weeks before the neck dissection, although open to certain criticisms is the most popular procedure

VARIETIES OF OPERATION

TONGUE AND FLOOR OF MOUTH —The operations upon the tongue and floor of the mouth have been roughly divided into three groups (*a*) intrabuccal operation, (*b*) removal below the jaw, and (*c*) removal by division of the jaw

Intrabuccal Operations —The typical intrabuccal operation is that described and practised so well by Whitehead It was designed before the dissection of the various groups of lymphatic glands was introduced as a routine method, and is done entirely independent of the neck operation, which may or may not be performed immediately or at a subsequent period The upright position of the patient is essential A ligature is passed through the tip of the tongue, which is drawn forward, and upward to its fullest extent The frenum

and the mucous membrane on one side of the tongue as far back as the anterior pillar of the fauces, are divided. When the whole tongue is to be excised, the same is done on the other side. If one-half of the tongue only is to be removed, an incision is made along the dorsum on the median line, and the tongue split back along its raphé. The surgeon now draws the diseased half upward and forward to make the geniohyoglossus muscle tense, and divides it close to its point of origin. The tongue can now be drawn out, so that the remainder of the operation is almost extra-oral. Whitehead operates upon the glands of the neck at a second operation at a later date, when he has reason to consider them to be malignant, but it is clear from the various descriptions of his operations, that there are many cases in which the intrabuccal operation is performed alone.

Butlin performs an intrabuccal operation which does not differ essentially from that of Whitehead, although he places his patient in the lateral position and performs a preliminary laryngotomy. Butlin, however, lays great stress upon the dissection of the neck, which he performs as a secondary operation. He aims to remove all of the lymphatic glands and the lymph-bearing tissue of the inferior and superior deep cervical, the submaxillary and the sublingual groups. The muscles and the great vessels are cleaned of fascia and fat, the submaxillary salivary glands are removed entire, and the submental region thoroughly dissected. Where the disease is near the median line, both sides of the neck are dissected.

Poirier performs an operation similar to that of Butlin, although the intrabuccal operation and the neck dissection are done at one sitting, the two wounds, however, do not communicate.

Crile's "block dissection" of the neck deserves special mention, as having been worked out on a physiological and pathological basis. Crile has proved that the structures of the neck can be safely sacrificed in the extirpation of cancer to an extent that has not been before believed. The removal of the sternomastoid muscle causes little inconvenience, the omo-

hyoid, the digastric, the sternothyroid and sternohyoid and the platysma are of minor importance. Unilateral excision of the vagus is attended by hoarseness of the voice, but this is of very little consequence. Unilateral excision of the phrenic is followed by less than half paralysis of the diaphragm. Unilateral excision of the hypoglossal nerve affects the tongue somewhat in speech, but a fair degree of compensation is acquired. Bilateral excision is usually fatal from pneumonia. Removal of one or even both internal jugulars is of little consequence, but a compensating route for collateral circulation must be assured before the second jugular is tied. Thus, all of the structures of one side of the neck, with the exception of the common carotid artery, may be sacrificed if necessary. Crile has elaborated the technic of this operation to permit the removal of these tissues in a block dissection. With the semi-upright position, safeguarded by the pneumatic suit, intubation of the pharynx and temporary closure of the common carotid, this extensive dissection can safely be performed. In cases of cancer of the tongue and floor of the mouth, Crile performs an intrabuccal excision similar to Whitehead, and follows this, after a period of about two weeks, with a block dissection of the neck, going up to, but not into the buccal wound. He lays stress also upon the reduction in the number and intensity of surgical contacts, such as forcible retraction, vigorous and repeated sponging, and blunt dissection. Hemorrhage, mismanaged anæsthesia and duration of operation are also important factors in the production of shock. Crile also follows up his operation upon the neck by X-ray exposure of the open wound during the period of convalescence.

Among the 62 cases of cancer of the tongue and the floor of the mouth which were operated upon at the Massachusetts General Hospital, 20 intrabuccal excisions of the tongue were performed, and the end results are known in 19 of these cases. In 7 cases, the neck dissection was performed, while in 13 no operation upon the neck was done. Of all the 20 cases 8 are now alive and well, or have died without recurrence over

3 years from the time of operation, giving 40 per cent of cures, a much higher ratio of successful cases than has been obtained by other methods of more radical operation, 7 of the 8 cures resulted from intrabuccal excision of the growth without the dissection of the neck. The operative mortality of the 20 intrabuccal operations was 1 case, 5 per cent, death in this instance being due to general sepsis. To compare with these figures, we have the report by Whitehead of 139 operations for cancer of the tongue, 101 of which were for cancer restricted to the tongue itself, with a mortality of only 3 per cent. So far as the Massachusetts General Hospital cases are concerned, it would appear that the early and more favorable cases were the ones chosen for the intrabuccal operation. All of these successful cases are substantiated by microscopic examination of the specimens, and it is hard to believe that cures would have resulted had the excision not been performed before the glands of the neck had become involved.

Operations Below the Jaw—Although many modifications of this operation have been devised by different surgeons, the fundamental principles may be attributed to the early description of this operation by Kocher. An angular incision is carried from the chin to the ear, reaching downward as far as the hyoid bone. The submaxillary group of glands are dissected free, and the mouth is entered below the jaw by division of the mylohyoid. The diseased portion of the tongue and floor of the mouth is removed below the jaw, and the dissection of the neck and removal of lymphatics and other cancerous tissues is carried to such an extent as may seem to be required. This is the operation which commonly goes by Kocher's name, although he later adopted a division of the lower jaw after the method of Syme.

Regnoli's operation, one of the oldest from an historical point of view, makes use of the same principles as Kocher's, and removes the tongue through the middle of the floor of the mouth beneath the chin. It can be applied to cases of cancer near the tip of the tongue, and at the frenum, but should be supplemented according to modern views, by dissection of the

neck In cancer of the floor of the mouth, on one side only, in this region, the submental incision may be limited to one side and the operation made partly buccal and partly cervical, as the reporter has done with success on several occasions Kuttner performs the Kocher operation, and recommends a "luxurious" extirpation of the primary growth Eisendrath performs a similar operation, as do Kammerer and Willy Meyer Boyd and Unwin consider that removal of the tongue beneath the jaw invites cancerous infection of the neck, and increases the danger of recurrence The two-stage operation cannot well be performed by this method, and for that reason alone the operative mortality must probably be higher than with intrabuccal operations In the Massachusetts General Hospital series, Kocher's excision below the jaw was performed in 29 cases, with an operative mortality of 3, or 10.3 per cent, death being due in each case to sepsis and bronchopneumonia There were 2 cures among the 29 cases, or 6.9 per cent To contrast with these figures, we have Kocher's own cases as reported by Sachs, 58 operations, 12 of which were by excision beneath the jaw, with an operative mortality of 8.3 per cent Meller reports 2 cases only by this method of operation, both of which survived Butlin estimates the mortality of this operation in 62 collected cases as 20 per cent There can be little question that the operative risk is much increased over that of the intrabuccal operation, as far as cure is concerned, the cases submitted to this operation at the Massachusetts General Hospital cannot fairly be compared with the earlier and more favorable cases in which the intrabuccal operation was performed

Excision by Division or Resection of the Jaw—Langenbeck's method, as modified by Von Bergmann, is the one generally referred to in literature when it is intended to reach the disease through the lower jaw by dividing the bone An incision is made from the angle of the mouth through the cheek to the masseter muscle, and continued downward through the submaxillary and hyoid regions The lingual artery is tied and the lymphatic and salivary glands are dissected and

left hanging to the floor of the mouth. The lower jaw is then divided obliquely with a Gigli saw, the fragments are separated and the disease removed as on the surface of the body. Von Bergmann sutures the remaining mucous membrane in such a way as to establish a fistula to drain the region of the epiglottis and base of tongue. The bone is wired. This operation is one adapted as well to the removal of malignant disease of the floor of the mouth, tonsil, soft palate or pharynx, as of the tongue. It is necessarily employed in connection with excision of a portion of the jaw, when the jaw itself is involved in the disease.

The operations of Sedillot or Syme, which aim to expose disease of the tongue and floor of the mouth by a median incision, and division of the jaw at the symphysis, belong in the same class. Operations of this character are designed especially for advanced cases of carcinoma, and give a high mortality. In the Massachusetts General Hospital series there were 13 operations for cancer of the tongue and floor, in which the jaw was divided or excised, and 4 of these cases died soon after operation, a mortality of 30.7 per cent, which may well be contrasted with the 10 per cent mortality of the Kocher operation, or the 5 per cent of the operations of the Whitehead type. In the Massachusetts General Hospital series also, there were no cures in any of these 13 cases, although in 2 of the number a final report could not be obtained. The causes of death were sepsis in 1 case, and pneumonia with or without sepsis in 3. Sachs gives the operative mortality of jaw resections as 19 per cent. Butlin gives the mortality for 47 operations as 25 per cent. Meller reports 7 cases of cancer of the tongue in which jaw section, or resection was done, and of these 3 died soon after operation, or 42.8 per cent. It would be futile to deny that section or resection of the jaw adds enormously to the gravity of the operation, and it is only to be regretted that many patients present themselves with their disease so far advanced that one of these grave operations must be performed, if anything at all is to be done to ward off the otherwise inevitable death. It is true that in none of the

Massachusetts General Hospital cases was this desired result obtained, but the attempt at least was made, and in the long run life was prolonged. When we realize the immense advantages of the free approach to the disease which is given by division of the jaw, it becomes a question whether, with a proper technic, this should not be adopted more frequently (and in early cases) instead of being placed among the discarded features of the operation.

A good deal is said about anatomical relations, in connection with these operations, but it must not be forgotten that in the words of a distinguished surgical teacher "Anatomical considerations must be made subservient to the one grand purpose of the operation,—eradication of the disease."

Operations for the cure of cancer in this region are distinctly less far advanced than those for cancer of other portions of the body. The mechanical difficulties to be overcome are greater, the lower jaw offers a barrier to the free sweep of the knife. The presence of important nerves and vessels in the neighborhood, and the severity of the operative attack, add greatly to the dangers of the operation itself, while the close relations of the air-passages and of the buccal tract make the problem of a safe and speedy convalescence much more difficult. It is not to be wondered at that a large number of cases have hitherto been regarded as bad surgical risks, and that many are turned away as inoperable cases when they first present themselves at the clinic. Of 172 cases of cancer of the tongue and mouth at the Massachusetts General Hospital, 50, or 29 per cent, were already inoperable, and 10 others refused any operation.

Modern research has given a distinct impulse to surgery of the mouth. Discussion turns no longer on primary ligation of the lingual artery, but upon the distribution of the cervical lymphatic glands. All writers dwell upon the danger of handling the diseased tissue, and of bringing softened gland-substance or the secretion of ulcerated surfaces in contact with the wound, and some go so far as to irrigate the open

wound with antiseptics to prevent the artificial propagation of the disease

The extent of operation upon the tongue itself is a question upon which authorities do not agree. In cancer of the breast, or of the uterus, there is of course no question but that the whole of the organ is to be removed. The conditions in the tongue, however, are peculiar. Almost completely separated into two symmetrical parts by the median raphé, it has many of the characteristics of a double organ. There are two sets of blood-vessels, two sets of nerves, and a double set of lymphatics. Each of these systems, though anastomosing across the middle line, is anatomically distinct. To this is added the clinical experience so often noted,—that cancer remains restricted to one side, and does not readily cross the raphé. This barrier, however, is an imperfect one, and in advanced disease reliance cannot be placed upon it. In early cases, however, the healthy half of the tongue can frequently be saved. It is also worthy of note that cancer does not spread toward the tip of the tongue, but rather toward the base. For this reason, the tip can often be saved and the edges stitched together, or folded on itself to form the so-called "parrot-tongue", a measure which aids in closing the wound and helps to improve the speech. Especially is it to be remembered that the capillary lymphatics of the base, and those of the body of the tongue, are developmentally and anatomically quite distinct, for in the majority of cases this gives the surgeon the opportunity to leave enough of the base of the tongue to form a serviceable stump.

Of 98 cases of cancer of the tongue and floor of the mouth at the Massachusetts General Hospital, 62 were operated upon, but in 5 cases the end result could not be determined. From the remaining 57 operations, 10 cures resulted, 9 of these cases were alive and well at the following periods after operation $3\frac{1}{3}$, $3\frac{7}{12}$, $4\frac{1}{6}$, $6\frac{8}{12}$, $7\frac{6}{12}$, $11\frac{8}{12}$, $12\frac{4}{12}$ and 13 years, and 1 died of heart disease 6 years after without recurrence. One of the 10 had a local recurrence (or a new attack of the disease) 8 years after the first operation, but this was removed

and the patient has now been well for 5 years. The percentage of cures in these cases is thus 17.5 per cent, or if (following the example of Meller) only the total of operated cases is considered, 10 in 62, or 16 per cent. Carrying the time limit on to 5 years after operation, all of the cases operated upon in 1902 and 1903 are thrown out, leaving 45 cases with 7 cures, or 15.5 per cent. Comparison with other statistics is difficult, because of the varying requirements established by different writers. The Massachusetts General Hospital cases are taken consecutively from the record books. All of the cured cases are supported by microscopic examination of the specimens, and no case is included which has not survived a period of at least 3 years since operation. The best results claimed by any surgeon are those of Riedel (of Jena),—24 operations with 8 cures, or $33\frac{1}{3}$ per cent (Jahr). Butlin gives 24.7 per cent as his latest percentage of cures. From these figures the percentages run down, depending largely upon the rigidity with which the statistics are scrutinized, to much smaller figures. It is probable that 17 per cent comes close to the average expectation of cure in any of our general hospitals.

The operative mortality of operations for cancer of the tongue and mouth depends largely upon the nature of the operation performed, and has been already discussed. Of the whole number of 62 operations, 8, or 12.9 per cent, resulted fatally.

When the disease was confined to the tongue or floor of the mouth, at its point of origin, as in 29 cases, cure was obtained in 31 per cent. When other structures were involved, the percentage of cures was only 3.4 per cent.

Recurrence of the disease took place in 40 of the 57 patients operated on, in whom the result is known. In only 2 cases did a patient with recurrence live over 3 years after operation.

In 13 local recurrence alone occurred. In 14 both local and glandular return of the disease, and in 8 the recurrence was in the lymphatic glands alone. Even in cases of recurrence life was prolonged by operation.

LOWER JAW

Operations for cancer of the mucous membranes of the alveolar process of the lower jaw, and involving the bone, permit of little difference in extent, although the technical details of preparation, position of patient, anæsthesia, the use of clamps, and the protection of the air-passages, may be varied as in the case of operations upon the tongue. Any radical operation involves the excision of a part, or the resection of the whole of one or both halves of the inferior maxilla. There were 40 cases of cancer of the mouth involving the lower jaw in the Massachusetts General Hospital series, 28 of which were submitted to operation, 10 patients died as a result of the operation (35·7 per cent),—a large mortality,—and there were 5 cures (17·7 per cent), or, of the traced cases, 19·2 per cent. Taking 5 years as the limit for a cure, 22 cases are available with 3 cures, or 13·6 per cent. There were no cases of recurrence over 3 years after the operation.

The operations performed upon these 40 cases were as follows

Resection alone, 12	1 cure, 5 operative deaths
Resection + neck dissection, 4	1 " 2 "
Resection + neck + other parts, 3	1 " 1 "
Minor operations, 7	2 " 2 "

It is thus apparent that any operation upon the lower jaw for cancer is attended by considerable risk. The causes of the 10 operative deaths were

Shock and hemorrhage	3
Sepsis	1
Sepsis and pneumonia	2
Secondary hemorrhage	1
Debility, heart lesions, etc	3

Bryant gives the mortality for resections of the lower jaw as 20 per cent, and from Meller's case-reports, 36 cases of cancer involving the lower jaw and requiring resection or excision, have been tabulated with results as follows: 36 cases,—7 cures (19·4 per cent) and 6 operative deaths (16·6

per cent) These are the only figures available for direct comparison, but they show a notably lower operative mortality, although the cures are practically the same Because of the high mortality, the neck dissection might perhaps better be postponed for a later operation

UPPER JAW

Operations for cancer of the mucous membranes covering the alveolar process of the upper jaw and the hard palate, like those involving the lower jaw, admit of little variety except in the extent of the operative attack There were 14 such cases in the Massachusetts General Hospital series, with 10 operations and no cures Meller gives the histories of 12 such cases with 1 cure, and Boyd and Unwin 1 case, with recurrence There were no operative deaths in the Massachusetts General Hospital series, confirming the general belief that operative attack upon the upper jaw is less dangerous than that upon the lower jaw There were 5 total resections, 1 partial excision, and 4 minor operations, but in no case was the dissection of the neck attempted This, however, was not the only reason for the lack of success, for 8 of the 10 cases at least showed local recurrence, and it is evident that the primary tumor was not completely extirpated It is interesting to note that in one of the inoperable cases of this character enlarged axillary glands were removed and found to be involved with epithelioma

TONSIL AND PALATE

The region of the tonsil and pharynx may be approached by several different routes for the extirpation of malignant disease "Trans-hyoid pharyngotomy," as performed by Carless, gives access especially to the base of the tongue and epiglottis For this purpose a median incision is made from the chin to the thyroid cartilage, bisecting the hyoid bone The edges of this wound are retracted, and the pharynx entered between the top of the epiglottis and the false cords Tracheotomy is a necessary adjunct Cheever enters the

pharynx through a cervical incision following the line of the angle of the lower jaw, dividing the stylohyoid and styloglossus muscles, and separating the fibres of the superior constrictor.

Mikulicz's operation involves a division of the angle of the lower jaw, and dislocation and resection of the ascending ramus. It is comparable to the operation upon the tongue of Langenbeck, and to the resections of the lower jaw, and should give a similar high mortality. Boyd and Unwin report 4 cases of cancer of the fauces, on which they performed an operation of a similar nature to Mikulicz's, with the addition of the neck dissection. There were no operative deaths, but there were no cures.

The reporter finds a modification of Langenbeck's operation combined with a block dissection, the most effective method of reaching the region of the tonsil, palate and base of the tongue. The incision runs from the angle of the mouth vertically downwards to the lower edge of the jaw and along the lower border of the jaw as far as the lobe of the ear. The cheek is separated from the bone, and thrown back. The superficial fascia of the neck which is attached firmly to the lower edge of the horizontal portion of the jaw should be divided as far back as the angle of the jaw, the facial artery being clamped, cut and tied. A blunt dissector slipped into the incision liberates the floor of the mouth on that side from the inner aspect of the bone by a few brisk to and fro sweeps of the instrument. The soft parts drop towards the median line and the approach to the tongue and the mouth is greatly facilitated. The jaw is now divided in front of the masseter and the ramus thrown backward with the skin flap. An extension of the incision downward along the anterior border of the sternomastoid muscle uncovers the infected gland area. This operation exposes the mouth and pharynx so that any disease, however extensive, becomes easily accessible, and the surgeon is, as it were, operating on the surface of the body. The primary and secondary lesions can be removed "*en bloc*," and the operation completed in a comparatively short time and

without undue hemorrhage and shock. There need not be as much hemorrhage as in an operation for cancer of the breast. In less advanced cases with the same skin incision, and without dividing the bone, the neck having been dissected, the operation on the mouth becomes a simple matter, and the diseased portion of the tongue is removed together with the glands. The facial incision recommended gives far less deformity than the splitting of the cheek, and gives access to the mouth, bone and the upper part of anterior triangle.

Of 11 cases of cancer of the tonsil, fauces and soft palate in the Massachusetts General Hospital series, only 4 were considered suitable for operation. One case, an epithelioma of the soft palate, removed by excision through the mouth was cured (7 $\frac{10}{12}$ years). Of the other cases, 1 was merely cuietted, while 2 were given radical operation with dissection of the neck, and removal or division of the jaw. There were no operative deaths, but 2 of the 3 cases had a local return of the disease, and the other died of cancer, though the site of recurrence could not be determined. Of the 7 inoperable cases, all showed enlarged glands in the submaxillary region, or anterior triangle of the neck.

Meller records 16 cases of cancer of the tonsil or palate, with 1 cure (6.2 per cent), and quotes the figures of Hensel (7 cases and no cures), Boyd and Unwin report 5 cases with no cures. It would appear that under existing conditions, only the earliest and most favorable cases can expect radical cure of the disease, and that the local excision should be more generous if cure is to be attempted for cancer in this portion of the mouth.

CHEEK

Standard operations for cancer of the mucous surfaces of the cheek are not yet in existence. Morestin suggests the following operation. Two long incisions starting from the labial commissure, or including a portion of each lip, and, including between them the diseased area, run as far as the anterior border of the sternomastoid muscle. Exposure and

dissection of the submaxillary triangle follows, with ligation of the facial artery, separation of the floor and of the mouth from the diseased mass, and liberation of the mass *en bloc* from its surroundings by deep dissection and by division of the jaw near the median line, division of the ascending ramus and removal of the growth. The mucous membrane of the floor of the mouth is stitched to that of the upper buccal fold. The large gap left is closed at a subsequent operation. Morestin advises light chloroform narcosis, and rapidity of operation. Although the hemorrhage is severe, but 1 of the 10 cases succumbed. He mentions 3 cases well at least two years after the operation out of a collection of 25 cases, some of which were inoperable. He emphasizes the importance of removing the part of the lower jaw which is involved in the disease. In 1 of his successful cases, an operation of this type was performed in the early stages of the disease.

Boyd and Unwin report 10 cases of operation for cancer of the cheek, involving the gums back to the coronoid process and including the sulcus of the cheek. They found intrabuccal operations unsatisfactory, nor was splitting the cheek wholly satisfactory. They advise dividing the lip and chin in the median line, and turning the cheek back. A portion of the bone may be removed, if involved, in one piece with the disease. Division of the jaw should be made or the ramus removed in whole or in part if the growth requires it. When there is danger of closure of the jaws from cicatricial contraction, a wedge of bone should be removed at the time of the operation to ensure permanent mobility of the jaw.

It would appear that Morestin and Boyd and Unwin include under cancer of the cheek, cases which we have classed under the upper and lower jaw. Boyd and Unwin, however, report 4 cures in 10 cases, 40 per cent, and Meller in his report details 8 cases of cancer of the cheek, of which 2 were cured; so that the results in the Massachusetts General Hospital series of 9 cases with 8 operations and no cures, appear to be less favorable than may reasonably be expected. The operative mortality of the Massachusetts General Hospital

cases, 2 deaths in 8 operations, or 25 per cent, is also higher than seems justified. These deaths were due to shock in 1 case, and delirium tremens in another. The 8 operations were, 3 of them of a local and palliative nature, and 5 were radical excisions, involving the jaw in 2 cases, and accompanied by dissection of the neck.

Five of the 8 operations, however, were followed by local return of the disease, and in 2 of this number there was glandular recurrence also.

RÉSUMÉ OF OPERATIONS AND RESULTS

The prospects of radical cure by operative attack upon cancer of the tongue and mucous membranes of the mouth appear to be inferior to those devised for the cure of cancer in other regions of the body. This is chiefly due to the anatomical and physiological conditions, which make extensive operations in this region extremely dangerous to life. It may truthfully be said that surgical attempts to remove cancer in this portion of the body, have too often been confined to excision of the primary growth and that in the majority of cases even this attempt has not been sufficiently radical, and a wide enough margin of sound tissue has not been removed to justify the procedure as an attempt at radical cure of the disease. Too often the lymphatic glands are entirely disregarded, of 112 operations upon cancer of the tongue and mouth in the Massachusetts General Hospital, in only 51, or 45.3 per cent, was any attempt made to dissect the cervical lymphatics. It is true that a certain number of these operations were undertaken only as palliative measures, but in 10 of the 16 cures simple excision of the primary growth was the only operation done. From this we may judge that it was only the earliest and most favorable cases in which a cure resulted, and the total of 16 cases, or 14.2 per cent, of all cases submitted to operation, is sufficient indication that more radical operation is required if greater success is to be obtained.

Local recurrence of the disease took place in 39, of the total number of 49 operation cases, of which we have accurate

record, while glandular recurrence is noted in only 20 Of the other cases specific details are lacking

From these figures we may conclude that the local as well as the lymphatic portion of the operation was deficient in extent

PALLIATIVE TREATMENT

Since the radical cure of cancer of the tongue and mouth fails in a certain, and at present considerable number of, cases, palliative treatment must be considered It has long been claimed that the duration of life was greater after operation even when recurrence ultimately took place, than in unoperated cases This appears to be true in our statistics Leaving out of consideration the operative deaths (20) and the cures (16) in the whole number of 112 operations of the Massachusetts General Hospital series, the duration of life was notably longer in the cases which were admitted to operation, in every class

	Unsuccessful operation average	Inoperable cases average
Tongue	12-1 months	7-0 months
Lower jaw	10-9 "	5-4 "
Upper jaw	14-5 "	6-5 "
Tonsil	11-3 "	6-4 "
Cheek	8-6 "	7-0 "

The attempt at radical cure might thus be considered a palliative operation in the cases where radical cure is not obtained So far as comfort is concerned, there are no statistics to support the opinion, but it is a wide-spread one, that the comfort of the patient is much enhanced by even a partial removal of the offensive ulcerating and necrotic tissue in the mouth

Division of the lingual nerve to relieve pain is not performed as frequently as in former days When done, a portion of the nerve should be excised The Middlesex Hospital reports 9 cases (before 1870) in which this operation was done on one or both sides, with slight improvement in 3

Ligature of the lingual arteries in inoperable cases is advised by many writers (Kuster), and is claimed to diminish notably the rapidity of growth, I have no personal knowledge of the efficacy of this procedure

Hygiene of the mouth and the insufflation of powders containing borax, iodoform or morphine, and the use of cocaine in solution, and packing with iodoform gauze, have all been recommended as effective measures of relieving pain and fetor

In some cases the Rontgen rays seem to have a restraining influence on the glandular growth, but the successful cases reported in literature are few and unconvincing. In two cases in which this treatment was tried by the reporter, the glands softened and an enormous ulcer formed, covering the neck from jaw to clavicle. Radiotherapy has, however, achieved a certain success in some of the milder forms of the disease. De Beurmann reports a case of leucoplakia followed by a tubular epithelioma which disappeared under treatment by Rontgen rays, but the case was too recent for a definite result. Others report favorable cases similar to this, but the general experience seems to be that in the more active form of epithelioma the lobulated or nest-cell containing type, temporary improvement is followed by a sudden exacerbation of the disease, and this latter type is, as we have seen, by far the most common form of epithelioma.

The action of *radium* on epithelioma of the mucous membranes has been well tested by Abbe. He has used this remedy in 8 inoperable cases of cancer of the tongue, and concludes that it is as distinctly beneficial at the start, as in epithelioma of the skin, but that in no advanced cases of the disease when it has invaded the muscle of the tongue has it yet been finally curative. In three cases of growths in every way resembling epithelioma, but occupying as yet only the superficial layers, a rapid and easy cure has followed.

He concludes that from our present experience we can expect a cure in the early stage of cancer only, but that further study may reveal that a more correct estimate of the amount

of the dosage of radium application or some improved method of using it will give finer results, even in advanced cases

The conclusions which we may derive from a review of the literature and an analysis of these statistics of cancer of the mouth and tongue are as follows

1. The relation of the lymphatic system to the primary growth is the most important anatomical consideration in operations for cancer of the mouth and tongue

2 Chronic inflammatory processes of the mucous membrane which do not yield promptly to local treatment, are of importance as predisposing or precancerous conditions, and should be treated surgically

3 Cancer of the mouth and tongue is a local disease limited to the tissues immediately surrounding its point of origin, and to the adjacent lymphatic system Internal metastases are rare

4 Microscopical examination of the primary growth should be made the crucial test of diagnosis in doubtful cases, and should be done preferably at the time of the operation Antisyphilitic treatment is not a sure guide, and should not cause delay in surgical interference

5 The modern operative treatment of cancer of the mouth and tongue involves

a Preliminary treatment of the cavity of the mouth,

b Protection of the respiratory tract by drugs, and by intubation of the pharynx, or laryngotomy, or by position;

c Removal of the primary lesion with a margin of one inch, if possible, of healthy tissue,

d Block dissection of the lymphatic bearing tissues of the anterior cervical triangle, on one or on both sides as a routine measure,

e A lower operative mortality may be obtained by performing the block dissection of the neck as a secondary operation about two weeks after the excision of the primary disease,

f The intrabuccal operation is inadequate to reach the entire operation field, and should be supplemented by a dissection of one or both anterior cervical triangles.

g The submaxillary route, although it permits a block dissection, does not give as free access to the diseased tissues as is demanded in an operation for cancer,

h The route through the jaw exposes the whole field of operation, and enables the surgeon to act as if operating upon the surface of the body, but division of the lower jaw as at present performed adds greatly to the surgical risk

6 The ideal operation of the future should contemplate a free exposure of the mouth and anterior cervical triangles as one continuous area, with a block dissection of its diseased contents. The use of mechanical devices for protection of the respiratory tract, and the perfection of technical details of the operation, along the lines already suggested, should enable us to perform an operation of this character without incurring the large mortality which is now to be expected

7 The mortality varies with the extent of the operation, and is lowest (5 per cent) with the intrabuccal operation, and highest (30-35 per cent) in the operations involving division or resection of the lower jaw. Death is, as a rule, attributable to shock, sepsis or bronchopneumonia

8 In a series of cases taken consecutively from the records of the Massachusetts General Hospital, 112 operations upon cancer of the tongue and mouth, resulted in 16 cases free from recurrence over 3 years after operation (14.2 per cent) (all supported by pathological examination of the tissue)

9 Of 57 cases of cancer of the tongue, 10, or 17.5 per cent, were cured by operation

10 Local recurrence of the disease occurred more frequently than recurrence in the lymphatic glands alone. In only one case did recurrence make its appearance at a period of more than three years after operation

REFERENCES

- BERKELEY, W W, Basocellular and planocellular cancer of tongue (*Proc N Y Path Soc*, 1905-1906, v, 169)
 BINDER, Cancer of tongue (*Beit klin Chn*, 1896, xvii, p 253)
 BOYD and UNWIN, Cancer of tongue (*Practitioner*, 1903, lxx, p 626)—
 Cancer of mouth and fauces (*Idem*, 1904, lxxii, p 397)

- BUTLIN, H T, Diagnosis of cancer of tongue (*Practitioner*, 1903, lxx, p 595)—Unsuccessful operations cancer of tongue (*British Med Journ*, 1903, 1, p 353)
- CHEATLE, G L, Diseases of tongue London, Cassel and Co, 1906—Precancerous conditions (*British Med Journ*, 1, May 26, 1906)—Spread of cancer in the tongue (*Practitioner*, 1905, lxxv, 623)
- COBB, F, and SIMMONS, C C, Results of operations for cancer of tongue, tonsil, etc, Massachusetts General Hospital (*Boston Med and Surg Journ*, 1905, cli, p 418)
- CODMAN, E A, X-ray treatment, post-operative, in cancer of mouth (*Boston Med and Surg Journ*, 1905, cli, p 424)
- CRILE, G W, Excision of cancer of head and neck (*Journ Am Med Assoc*, 1906, xlvii, 1780, *Surgery, Gynecology and Obstetrics*, July, 1907, p 91)
- DEANSLEY, E, Radical operation for cancer of mouth (*British Med Journ*, 1905, 1, p 1270)—Removal lower jaw, tongue and floor of mouth (*Idem*, 1906, 1, p 1342)
- EISENDRATH, D W, More radical operations for cancer of lips and tongue (*Journ Am Med Assoc*, 1906, xlvii, p 986)
- FRANKLIN, M, Radiotherapy in malignant conditions of mouth (*International Dental Journ* (Phila), 1904, xxv, p 905)
- GOLDSTEIN, M A, Malignant growths of mouth and pharynx (*Trans Amer Laryngological, etc, Soc*, 1905, x, p 151)
- HAYNES, J S, Epithelioma of tongue (*Annals of Surgery*, 1904, xlix, p 812)
- HENDERSON, G B, Multiple epithelioma of tongue (*Liverpool Med Clin Journ*, 1903, xxiii, p 395)
- HILDEBRAND, Cancer upper jaw (*Beit klin Woch*, 1906, p 32)
- ISRAEL *Zeitschrift für Chir*, 1906, p 37
- JACOBSON, W H A, 50 cases operation for cancer of tongue (*Practitioner*, 1903, lxx, p 604)
- JAHR, A, Dreissig Falle Carcinoma Linguae (Thesis inaugural, 44 pages in-8o, Iena, 1903)
- KUSTER, Zur Behandlung des Zungenkrebses, etc (*Arch klin Chir*, 1906, lxxxi, p 292)
- KUTTNER, Lymphgefäße der Zunge, etc (*Beit z klin Chir*, xxi, p 732)
- LEGG, T P, Carcinoma of tongue (*Polychmic* (London), 1906, x, p 158)
- LOCKWOOD, C B, Secondary infection of lymphatic glands in malignant disease of tongue (*Clinical Journ* (London), 1904, xiv, 113)
- LOTHROP, H A, and SCANNELL, D D, Results of treatment of cancer in and about the mouth, at Boston City Hospital (*Boston Med and Surg Journ*, 1905, cli, p 421)
- MCWILLIAMS, C A, Excision of tongue for epithelioma (*Annals of Surgery*, 1906, xliii, p 436)
- MELLER A, Zur Statistik der Schleimhaut Carcinome des Mundes und Rachens (*Deut Zeit f Chir*, 1906, lxxiv, p 105)

Curiously enough, glandular involvement of the tributary lymphatics is not necessarily deep nor extensive, even in advanced cases, as instanced in my own, and internal metastases may not be present at any time. It is this astonishing fact alone which gives us courage to attack these apparently hopeless cases by radical surgery, in the hope of affording even a lasting relief in some of them.

The magnificent work of Crile, in a large series of operations for the removal of extensive cancerous growths of the neck and face, by a block removal of all the affected tissues, whether bone, or soft tissue, after a temporary closure of the common carotid artery by his special clamp, points the way to results supposed hitherto to be unattainable.

A statistical paper¹ of great value, published last year by Anton Meller in the *Zeitschrift für Krebsforschung*, 1907, 16, 64, gives the results of a careful study of epithelial carcinoma of the head and neck, based upon the review of 327 cases of epithelioma observed in Hochenegg's clinic in Vienna, between the years 1894 and 1904.

The accumulated figures obtained from the study of such a great number of cases cannot help but be useful, and in this special instance, stimulating. It should serve also to correct various erroneous impressions which exist and which may have been derived from an unfortunate personal experience or from too hasty generalization based upon insufficient observation.

The results of the operation in this great series of cases are most interesting and suggestive. For example, it was found that in 50 per cent of them, there was no recurrence after operation, within the three-year period, and of those cases which were operated on for recurrence, 21 per cent remained free. Meller found moreover, that recurrence when it did occur was most often local, rather than in the glands, and that internal metastases had rarely occurred before the patients came to operation.

¹ Zur Statistik der Hautcarcinome des Kopfes und Halses

He found also that cancers in certain regions were more dangerous as regards glandular metastasis than in others, for instance, in the case of the lower lip, this involvement was found in 90 per cent of all of them, while in cancer of other parts of the head and face, gland involvement was observed in but 18 per cent to 43 per cent. It was found moreover, that the removal of infected glands up to the size of a pea or walnut, always gave good results when they only occurred in small groups or singly, but in those cases where the glands could be followed down to the clavicle, others would usually be found in the mediastinum.

Finally it was found that in really "inoperable" cases, an operation materially hastened the end by hastening extension along the opened up channels and mutilated tissues, and Meller declares boldly that similar bad results often follow rough attempts at removal of perfectly operable growths by inexperienced operators in this field of work, which statement is borne out by the observations of most surgeons.

During the past year, three cases of extensive epithelioma of the inner lining of the cheek and involving the jaw, have come under my care, and the condition in all of them was so distressing that an extensive mutilating and dangerous operation seemed justifiable as a measure of relief, even though the chances of a radical cure seemed somewhat problematical. The experience gained in my attempts to effect the removal *en bloc* of all the visibly infected tissues, whether bone, muscle or skin, in an orderly and comparatively bloodless manner, may not be without interest to those of you who may be called upon to advise or operate in similar cases.

In the first case, operated upon in June, 1907, at the Roosevelt Hospital, much valuable experience was gained, and an operative technic developed which was useful in the later cases which form the basis of this paper. Operative recovery resulted in this, as in the other cases, but recurrence at the site of the scar took place within two months, which, on account of the patient's age (65) and rather feeble condition, was not subjected to further operation, and he died

of exhaustion in about four months from the time of the operation. In this case a large piece of the cheek and nearly one-half the lower jaw were removed, and the defect was closed in by a plastic flap taken from the skin of the neck. The growth in this first case was more closely localized to the mucous membrane of the cheek and the alveolar process of the lower jaw than in the later cases, and in a younger and more vigorous subject, an operation would doubtless have given more lasting results.

In the two cases which form the real basis of this paper, and in which the steps of the operation to be described were developed, the growth had involved a very wide area, as will be seen, and while too short a time has elapsed to predicate the ultimate result, the writer feels that as recurrence at the site is more probable in these cases than at a distance, and with the hope that it may be perfectly feasible to deal with such recurrence in the event of its appearance, the operation is not only a justifiable procedure, but really a desirable one even if it affords only a respite from the suffering that these unfortunates are obliged to undergo.

Both cases are alive and well at the end of about three months, and both are steadily gaining weight, the first one having gained about twenty pounds and the second about ten pounds.

The following is a review of the history of these two cases.

CASE I. Francesco de G., Italy, age 43, M., ragpicker. Admitted to Bellevue Hospital, January 6, 1908. In America five years. Irregular habits as to eating, drinking, and sleeping. Moderately alcoholic. Smokes and chews tobacco. Syphilis, doubtful. Generally in good health. Family history negative.

Present Condition—About a year before a small "pimple" appeared upon the inner surface of the left cheek and was cut out by a physician, but never healed. The growth in the mouth began to ulcerate and to extend laterally and in depth, until the cheek was perforated about three months ago, since when his condition has become more and more wretched. There is no

history of injury to the jaw but the teeth have always been bad he says, though those adjacent to the growth had never troubled him and appear to be sound

Examination revealed an ulcer involving the whole thickness of the left cheek about the size of a silver half dollar, its centre opposite the 2nd molar tooth, its edges hard, irregular in outline and undermined, and the surrounding tissues widely infiltrated. There is a very foul smelling discharge from the ulcer and it is mixed with the saliva which is very abundant and very offensive. The pain extending up into the head is very distressing and sleep without opiates is impossible. There is spasm of the Masseter muscle with marked trismus, and it is difficult to pry open his jaw, even a little, to examine the inside of the cheek and determine the extent of the growth. The patient is beginning to emaciate and is rapidly losing strength. His feeding is limited to fluids, part of which are lost through the large whole in the cheek.

The lymphatic glands below the jaw are considerably enlarged and adherent to the skin and each other, but do not extend very far down the side of the neck, *i e*, apparently not below the level of the cricoid cartilage.

Examination of a section of the edge of the ulcer, shows it to be epithelioma. The patient has been refused operation at two hospitals, but, in view of his age, 43, and the comparatively small glandular metastasis, as well as of his urgent prayer for relief from his wretched condition, the operation was undertaken on January 11, 1908.

CASE 2 Walter T, U S, laborer, 52 admitted to Bellevue Hospital 1-1-'08. Family and previous history, negative. Generally in good health, moderately alcoholic, smokes and chews tobacco, pretty steady pipe smoker and in the habit of tucking his pipe into the right angle of the mouth, *i e*, on the affected side. His trouble began five months before with a small ulcer in the mucous membrane of the right cheek at a point which was constantly irritated by being caught between his teeth. The ulcer increased in size, slowly at first, but lately the whole cheek has become involved in what seemed to him an inflammatory process. Six weeks before he began to suffer from pain of increasing severity, which pain was in the cheek and extended up into the head and lately it had become so

severe that he could not sleep, and an increasing stiffness in the movements of the lower jaw had rendered eating a painful and unsatisfactory process

Examination shows a deep ulceration of the mucous membrane of the right cheek about opposite the second molar tooth, and extending to the alveolar process and backward to an extent undetermined on account of the inability to pry open the mouth wide enough to get a better view. The lymphatic glands in the submaxillary region were enlarged, very hard, but were not adherent to the skin nor did they extend far down the side of the neck

The heart and lungs are normal and there is no evidence of internal metastasis. Section from the growth shows it to be epitheliomatous, and an operation was advised. During his stay in the hospital his condition became more unbearable and the growth increased in extent until the cheek was finally perforated the day before the operation, which was done January 20, 1908

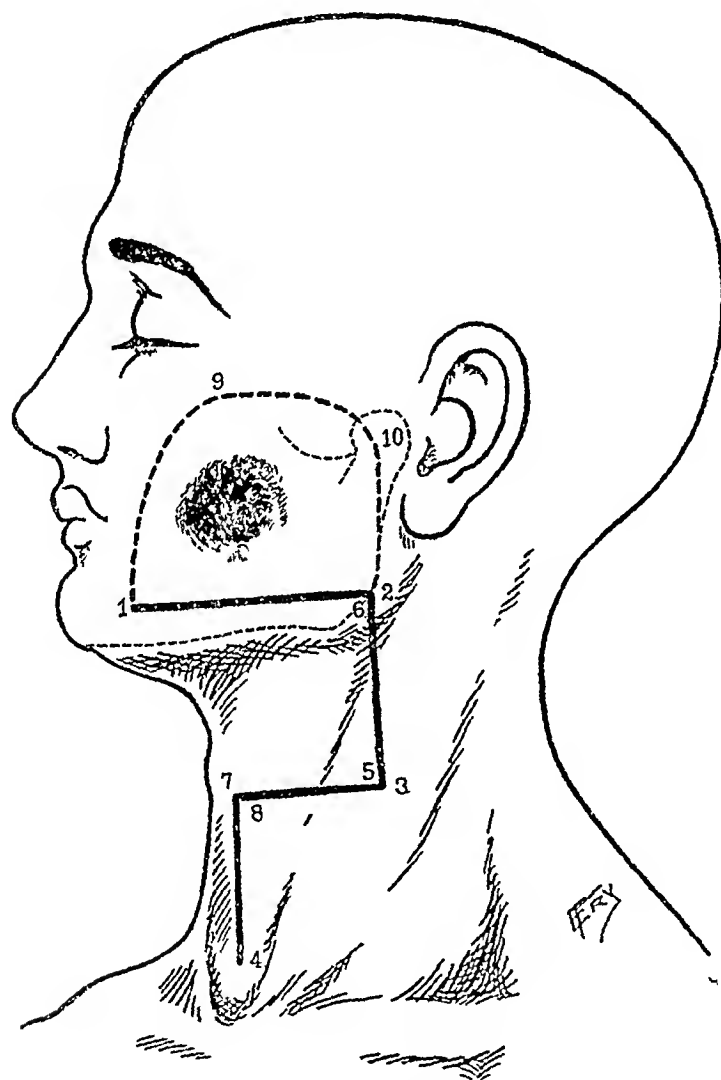
Both cases, it will be noticed, were comparatively young men, and, while their condition was far from promising, they both willingly submitted to operation. As the tissues of the cheek were very widely involved in both cases, necessitating a wide opening into the cavity of the mouth, it became evident that some form of plastic operation would have to be devised, which would provide for the immediate closure of this gap, provided it would not add materially to the length and danger of the procedure

With this in view, a plan of operative attack was worked out by which the growth in the cheek and jaw could be removed, together with the infected tributary lymph-nodes in the neck, in one piece, from below upward, with the least possible shock and hemorrhage, and the hole in the cheek rapidly closed by a plastic flap taken from the neck and turned back in the course of the exposure of the cervical lymph-glands to be removed

Description of the Operation—An incision (1, 2, 3, 8, 4—see Fig 1) was made through the skin, and the flap 1, 2, 3, 8, was turned forward toward the median line, exposing the lower border of the inferior maxilla, the platysma overlying the submaxillary gland, and the deep structures of the neck

The sternomastoid muscle was freed along its anterior border, thus exposing the chain of enlarged glands extending from the submaxillary space to below the level of the cricoid cartilage. Beginning below, the entire chain of lymphatic glands along the internal jugular vein and beneath the sternomastoid

FIG. 1

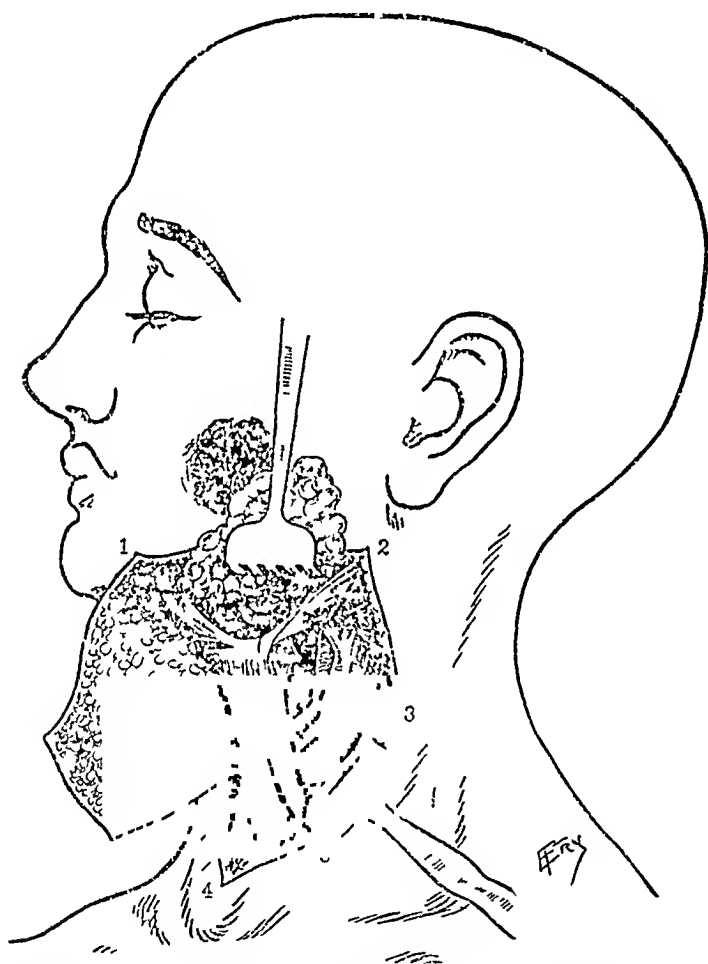


The heavy lines mark the outline of the flap from neck to cover defect left in cheek, portion circumscribed by dotted line

muscle was removed, together with any periglandular fat that might be adherent to them, in one piece, from below upward, until the bellies of the digastric came into view, and then the contents of the submaxillary space both the salivary and the lymphatic glands were shelled out cleanly and retracted upward in one piece. The external jugular and facial veins were ligated

and divided, and the external carotid artery was isolated and divided between ligatures of chromic gut, just above the origin of the superior thyroid branch. The outer surface of the lower jaw having been exposed and cleaned ready for section, and the neck-wound protected by gauze packing, the skin of the face was

FIG 2

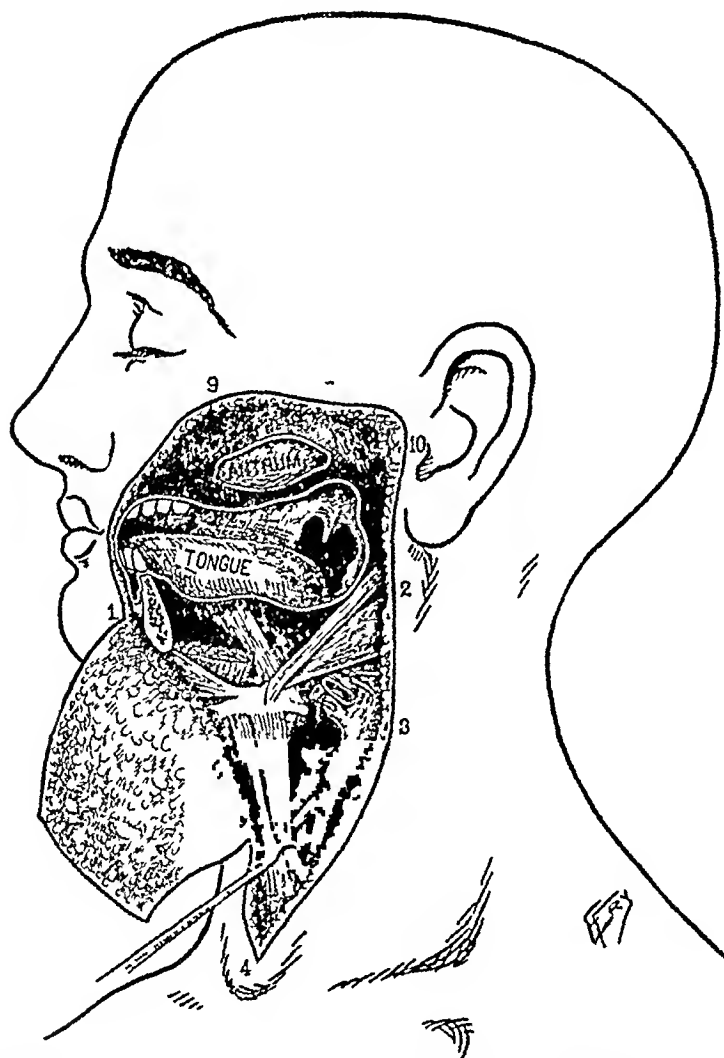


Skin flaps retracted, showing exposure obtained. Deep glands dissected up and extracted.
External carotid ligated

divided in such a manner as to widely circumscribe the growth along line 1, 9, 10, 2 (Fig 1) and the mouth rapidly entered. The jaw was then divided with a gigli saw through the socket of the canine tooth, the extent of the growth within the mouth being now plainly visible. When the cut end of the jaw was retracted, incisions through the mucous membrane well clear of the growth were made.

The mucous membranes and structures of the cheek were divided along the alveolar margin of the upper jaw, back to the molars and the floor of the mouth was divided along the groove of the tongue. This severed the mylohyoid and the hyoglossus muscles. The inferior maxilla and attached struc-

FIG 3



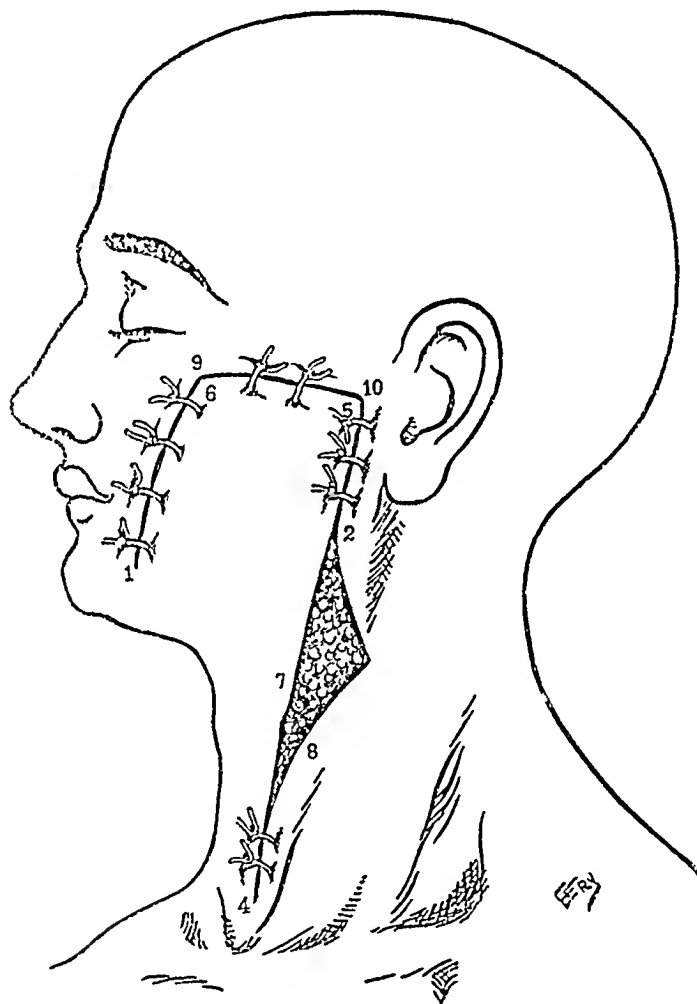
Tumor removed with large portion of cheek and $\frac{1}{2}$ the lower jaw and portion of upper jaw
Cavity of mouth opened

tures were then retracted outward, and, as the growth, in Case 2, was found to involve the posterior border of the alveolar process of the upper jaw and hard palate. The alveolar process of that bone was removed with a chisel from as far forward as the canine tooth and with it, the floor of the antrum, the pyramidal process of the palate bone, the lower end of the internal pterygoid plate, with hamular process, the lower end

of the external pterygoid plate, and a portion of the malar bone (see Figs 2 and 3) Upon disarticulating the inferior maxilla rather sharp venous oozing ensued, but was easily controlled by gauze packing

To close up the large defect left in the cheek, the mucous

FIG 4



Plastic flap from neck sketched in place covering defect in cheek

membrane at the side of the tongue was united to the cut edge of the hard palate, the tongue thus being elevated as a sort of wedge against leakage from the mouth. The edges of the cut mucous membrane in front and behind thus were united by suture, and the cut edge of the mylohyoid muscle was brought up over this line of union of the mucous membrane, and the skin

flap shown in figure 4 was then sutured up to fill in the defect in the cheek. A portion of the incision in the neck was left unsutured and filled with loose gauze packing extending up to the glenoid and temporal fossa, and this packing was left in place for several days until granulation was established.

The essential features of the operation are rapid, clean dissection with a sharp knife, careful retraction to avoid bruising of the tissues, isolation and removal of all the glands and infected fat in the area tributary to the growth, preferably from below upward, and with the least possible handling, ligation of the external carotid artery or temporary compression of the common carotid, after the method of Crile, stopping all bleeding, and finishing the work in the neck and clearing the jaw before the cavity of the mouth is entered, then rapidly removing the tumor, skin, bone, and infected glands, *en bloc*, and completing the operation as soon as possible by stitching the plastic flap into place and providing for drainage and suture of the neck.

The use of the tongue as a barrier to help close in the defect in the cheek is practical and tends to diminish the chances of early leakage from the mouth. The patients are bolstered up in bed as soon as out of ether and set up in a chair the second day if possible. Feeding through a tube passed through the nose becomes a necessity during the first few days after operation, especially if the rectum is intolerant, and allows healing to take place with the minimum of leakage and infection. Moderate infection occurred in both cases, but was not ever a serious factor. Some sloughing of the flap occurred in the first case, as it had to be shaved very thin by reason of the subcutaneous cancerous involvement, and the skin defect remains in cheek. In the second case, the flap was very effectual, although there are still one or two small points, rapidly closing in, where slight leakage from the mouth has occurred. Both patients are entirely relieved of their pain and both can eat solid food with comfort.

This operation, as described, is offered as an available method of attacking extensive growths of the cheek and jaw, the removal of which necessitates a wide opening into the cavity of the mouth, and in which it may seem best to do the operation in a single sitting instead of in two stages

It is original, in so far that the writer has never seen it done or described, but in this day of surgical progress one hesitates to call any operation a new one

The photographs were taken before the complete healing of the wounds and are offered merely to show the general outline of the plastic flap, and the deformity resulting from so extensive an operation. It will be noticed in the photograph of Case 2, that the cosmetic result is much the better, although the bone removal was much more extensive, possibly because the lower jaw was sawn farther from the median line in this case, thus preserving the outline of the chin

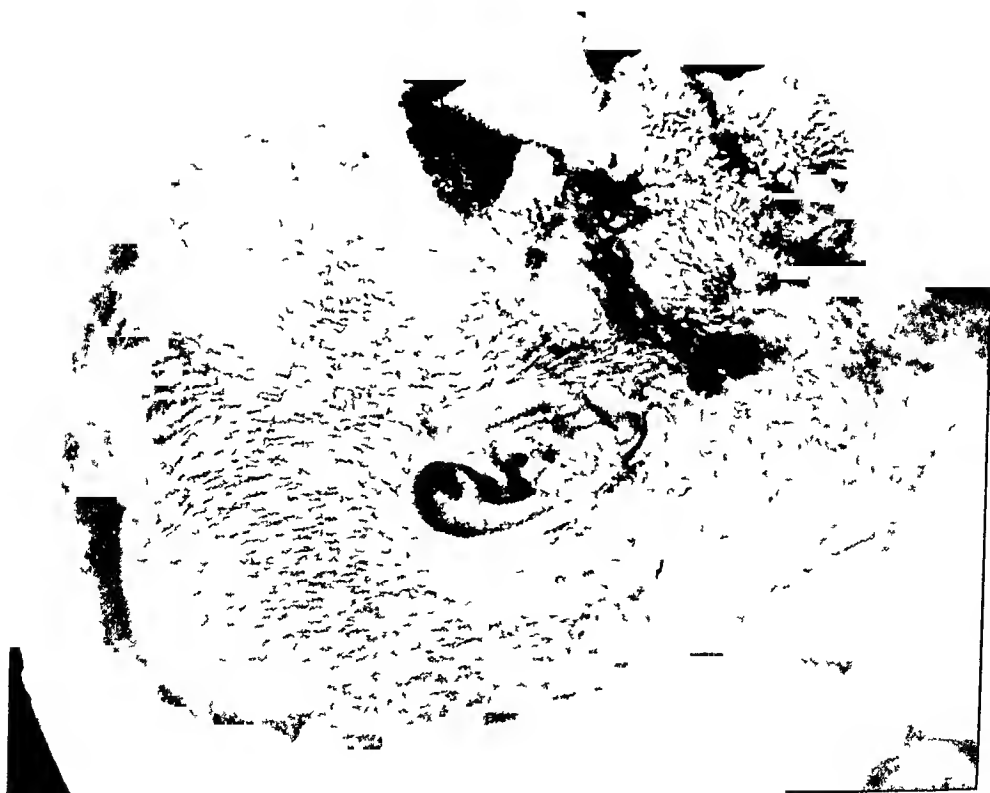
At the end of three months there is a slight local recurrence in the upper edge of the cheek opening in Case 1 which will be promptly removed. In Case 2 there are no evidences of recurrence. Both cases have enjoyed a period of complete respite from their sufferings, and both appear to be in good physical condition



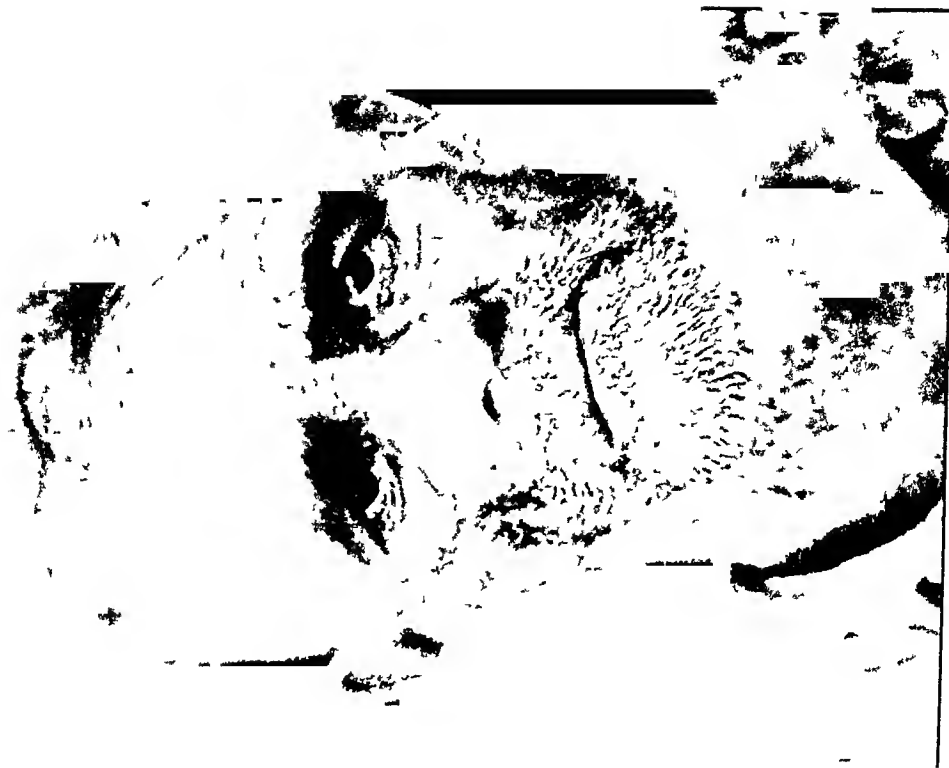
Front view, showing deformity about 3 weeks after operation

Side view showing plastic flap with partial neurosis of upper lip and angle

FIG 6



Side view, showing plastic flap in place, healing nearly perfect 2 weeks after operation



Front view showing the temporally slight deformity

RECURRENCE AT A LATE PERIOD AFTER OPERATION FOR CANCER OF THE BREAST

BY WILLIAM M MASTIN, M D,

OF MOBILE, ALABAMA

IN view of the renewed interest manifested in the end-results after operation for carcinoma of the breast that has appeared in recent surgical literature, and especially as shown by the symposium of papers on this subject read at the last meeting (1907) of the American Surgical Association, the herewith reported case of very late recurrence is interesting

Although Volkman's three-year period as a limit of safety after operation for carcinoma can no longer be accepted as a positive law, yet it must be conceded that a very large percentage of cases remaining well up to this limit are apt to continue on with freedom from recurrent disease. And statistics further demonstrate that with each succeeding year after this triennium period the fewer are the recurrences, until finally when the first decade is passed the number becomes so small as to warrant being considered as rare.

Among the symposium of papers mentioned, Joseph Ransohoff discussed the subject of very late recurrence after operation, and showed that of a small series of cases of late recurrence (after six years) he had collected, 10 occurred during the seventh and eighth years, 2 each after the ninth, tenth, eleventh, twelfth and fifteenth years, and 1 each after intervals varying from fifteen to twenty-five years.

At the same meeting, W B Coley reported 65 cases of recurrent cancer, of which 10 (15 per cent) recurred after three years, and 4 (6 per cent) after fourteen years. Of the latter number the longest duration was seventeen years.

But the very pertinent question has been asked whether these so-called late recurrences are actual recurrences or rather

new deposits or secondary growths in persons manifesting a cancerous predisposition. And along the same line, that such recurrence taking place in the scar at a distance from the location of the primary growth should be regarded as possibly a carcinomatous degeneration of cicatricial tissue. In substantiation of this view it has been shown that in some of these cases the histological type of the secondary or recurrent growth does not correspond to that of the original tumor,—presenting the features of both epithelial and connective-tissue growth. This, as has been stated, offers another point for thought, for it is reasonable to assume that a true recurrent growth should exactly correspond histologically to the primary tumor formation.

The incompleteness of the history of the subjoined case renders it quite impossible to assert whether the histological requirements exist or not. Again, the length of time the primary growth existed without involvement of the axillary glands, would cast a reasonable doubt upon the correctness of the original diagnosis, and suggest carcinomatous degeneration of cicatricial tissue. But, on the other hand, the pathological report of carcinoma from a competent source, the presence of a cancerous nodule in the very near vicinity of the primary focus, together with the absence of metastases either in the axillary lymphatics, or elsewhere in the viscera, place it properly, I believe, in the class of late recurrence as now recognized.

Carcinoma of the left mamma, excision three years after appearance, recurrence seventeen years and eight months after operation

A Sister of Charity, of the Order of St Vincent de Paul, at the age of 50 years, had the left breast removed for carcinoma, by a prominent surgeon of St Louis, in November, 1885. Microscopic examination confirmed the diagnosis.

From the appearance of the cicatrix, which is horizontal in direction, five inches long, and does not extend to the arm-pit, the operation was evidently a simple excision of the gland without invading the axillary space.

The patient states that the tumor growth was situated in the inner and lower quadrant of the breast, was painful and sensitive, had attained the dimensions of a walnut when extirpated, and was attributed to a violent blow received by coming in contact with the sharp edge of a door three years before. The lump appeared about two months after the injury, and was of slow growth. There was no axillary lymph-node involvement. The operation wound healed by primary union, and there was no evidence of recurrence of the neoplasm until the summer of 1903, a period of seventeen years and eight months from the date of operation. At this time she discovered a small nodule in the skin at the sternal end of the scar, which was tender and painful.

The present examination (September, 1907) discloses a stony-hard, irregularly roundish, movable mass, two inches and a quarter in diameter, occupying the inner angle of the cicatrix. Sharp, radiating pains are complained of, and palpation of the parts is decidedly painful. The inner third of the scar is depressed and firmly adherent to the growth, while the outer two-thirds are soft and free from attachments. The axillary glands are not palpable. A large mole, ovoid in shape, elevated, and of a pale yellow-pink color is located in the skin an inch above the outer side of the scar. This is dry not ulcerated, although the patient asserts that it occasionally exudes a slight serous fluid, and has largely increased in size during the last three years. There are no metastases and the recurrence seems to be entirely *in loco*, but there has been a slight rise of temperature in the evening—99 to 99½ degrees—for several weeks. She is fleshy and well-nourished, and regards herself as strong and in excellent health considering her advanced age of passed three score and ten years. She has recently undergone a successful cataract extraction on the right eye. Further operation was refused.

OSTEOPLASTIC RESECTION OF THE COSTAL ARCH, FOLLOWED BY RESECTION OF LESSER CURVATURE OF STOMACH AND ŒSOPHAGUS, AND ŒSOPHAGOSTOMY.

BY JOSEPH WIENER, M D,

OF NEW YORK,

Adjunct Surgeon, Mt Sinai Hospital

OWING to their extreme inaccessibility, largely due to the unyielding character of the chest wall, malignant tumors of the cardia and lower end of the œsophagus have until quite recently been considered a *noli me tangere*. True, these lesions are fortunately not common. Osler and McCrae in a series of 150 consecutive cases of carcinoma of the stomach found only two such cases.

Micheli, in a report to the Tenth Italian Congress of Surgeons in 1895, seems to have been the first to have worked out a definite operation for exposing the lower end of the œsophagus. He proposed and carried out on the cadaver, but never on the living subject, a thoracoplasty whereby a flap was raised, including the lower end of the chest wall, together with the diaphragm and parietal peritoneum. The operation would seem to be a very serious one, with considerable danger of injuring the pleura. Gottstein, in 1901, referred to two operations done by Mikulicz. In the first case he carried out a procedure similar to Micheli's. In his later case he made a median abdominal incision and several transverse incisions through which he divided the seventh, eighth and ninth ribs. Both of these patients of Mikulicz died from the effects of the operation, as in each case an extensive resection of the stomach was done.

* Read before the Surgical Section of the N. Y. Academy of Medicine, May, 1908.

Kelling, in 1901, after referring to an operation suggested by Lannelongue which he considers too mutilating (especially as we cannot at the start be sure that we will be able to do a radical operation), suggests a special posture for operations at the vault of the diaphragm. The head and trunk are to be on a table slightly elevated and the lower extremities hang vertically down over the end of the table with the feet resting on a pillow on the floor. This posture is similar to that used by anatomists in dissections of the diaphragm. A strap holds the trunk of the patient on the table, the leg holders are turned down and the patient is fastened with the spine bent in the dorsal and lumbar region. An incision is made in the median line and a second incision at a right angle extending to the tip of the twelfth rib. One of the objections to the posture is the difficulty in keeping the intestines within the abdomen, and a further objection is the difficulty in maintaining asepsis. The posture was not a practical one, and this led Kelling to modify it in an article published in 1904. In this article he recommends a pseudo hip-rest which is applied to the region of the diaphragm or liver. We have for several years been using a table at Mount Sinai Hospital which enables us by turning a handle to break the table into two inclined planes. In this way a deeply-seated gall-bladder or common duct or stomach, is made much more accessible. Dr Howard Lilienthal devised a similar portable table in 1903.

Marwedel, in 1903, described an incision for osteoplastic resection of the chest. He claimed for his incision that it was less complicated and less dangerous than those referred to above. He makes only one abdominal incision. It begins at the ensiform and runs parallel to the free border of the ribs and 3 cm from it, and extends to about the tenth rib. The seventh costal cartilage is divided close to the sternum. By blunt dissection the seventh, eighth and ninth ribs are laid free and divided close to the junction of the cartilaginous and bony portions. In this way a freely movable flap is obtained, and the exposure is surprisingly good. If necessary the sixth costal cartilage could also be divided. Beginning with the

seventh rib care must be taken not to injure the pleura. Towards the median line it is only necessary to divide the seventh rib, as the lower ribs do not reach the sternum. Marwedel performed the operation in a case of stenosis and spindle-shaped distention of the œsophagus due to cardio-spasm. At the operation he found the stenosis above the diaphragm and was unable to do the plastic operation which he had planned.

Asthoeuer, writing in 1903, referred to a case which he had operated on in 1894 through an incision similar to that described by Marwedel. The first incision was exploratory, at the outer border of the left rectus, this was enlarged upward to the free border. A second incision was made at right angles to the first, reaching to the tip of the eleventh rib, and a third incision parallel to the first extended from the eleventh rib upwards. The eighth, ninth and tenth ribs were divided as well as the costal cartilages of the seventh and eighth ribs close to the sternum. Through this incision a multiple fibroma of the spleen weighing seven pounds was removed. The patient died in twenty-four hours. In another case, operated on in 1902, Asthoeuer made a somewhat similar incision in an attempt to remove a sarcoma originating in the ribs on the left side. The tumor turned out to be inoperable, and the patient died seventeen days after operation. Asthoeuer points out that in some cases the costal arch is so broad and non-resisting that the osteoplastic operation may be unnecessary. On the other hand, with a narrow costal arch the resection within the limit of the cartilaginous portion of the ribs will not give good access to the dome of the diaphragm. And if we resect the ribs beyond the cartilaginous portion, we run the risk of injuring the diaphragm.

Willy Meyer, in 1906, reported two cases in which he had resorted to an osteoplastic resection of the costal arch.

The first case was that of "a boy 14 years of age who had an absolutely impermeable cicatricial stricture of the œsophagus (caustic lye). For eight years he had been fed entirely through a gastric fistula. All attempts to enter the stomach from above as well as under direct inspection with

the urethral speculum introduced through an œsophageal lip fistula in the neck having failed, an osteoplastic flap was raised by a V-shaped incision, the water-tight gastric fistula being carefully preserved. A part of the anterior wall of the stomach, well above the fistula, was thus reached, horizontally incised, and the passage upward searched for from below. To my great disappointment this attempt, too, proved unsuccessful. The œsophagus was evidently obliterated for some distance. The stomach incision was therefore closed again by means of a double row of Lembert silk sutures, the osteoplastic flap was fitted back in its place and the skin sutured, there was no drainage. The boy made a good recovery."

Willy Meyer's second case was one of multiple sarcoma of spleen. The abdomen was opened through a median incision, to this was added a transverse incision extending to the tip of the eleventh rib. The costal cartilages were exposed by blunt dissection. The seventh cartilage was divided close to its sternal attachment, then the seventh, eighth, ninth and tenth cartilages were divided near their junction with the ribs. This gave such excellent exposure that the large spleen was easily removed. The tumor proved to be a metastatic, small, round-celled sarcoma. The man made an operative recovery, but died suddenly of internal metastases ten weeks after operation. The autopsy showed good union of all the costal cartilages.

The author's case differed in several respects from those previously reported. The osteoplastic resection of the costal arch was done to accomplish a resection of the lesser curvature of the stomach and lower end of the œsophagus. The operation was done in two stages, thirty days elapsed between the osteoplastic resection and the resection of the stomach and œsophagus.

Sarah S., Russian, 45 years old, was admitted to Dr Lihenthal's service June 28, 1907 and came under the writer's care. Both parents had died of pulmonary disease presumably tubercular. With the exception of measles in childhood, the patient had always been well. She had been married 25 years, had had seven children and no miscarriages. Although she had been complaining of her stomach for ten years, she had only been vomiting for three months prior to her admission. During this time she had been vomiting small quantities almost daily, but only after eating. She had never vomited large quantities but there was frequent eructation of gas. She had often complained of slight pain and uncomfortable sensations in the left epigastric region. Constipation was marked and the patient had lost considerable

flesh No fever or jaundice had been noted The chief complaints were vomiting and loss of weight

Physical examination General condition good, fairly well nourished Tongue clean and moist, teeth and gums in poor condition There were no palpable glands The heart and lungs were normal, the abdomen adipose, large and flabby There was no abdominal rigidity but slight tenderness in the epigastrium on deep pressure No mass was palpable either in the supine or in the knee-chest position The liver was not enlarged to percussion, nor was it palpable below the free border of the ribs The spleen was not enlarged Vaginal examination showed a moderately enlarged uterus Rectal examination was negative A test meal showed the presence of lactic acid and the absence of free hydrochloric acid Dr G A Friedman who referred the case to the hospital deserves the credit of having made the diagnosis of carcinoma of the lesser curvature of the stomach

Operation July 1, 1907 *Exploratory Cœlotomy and Osteoplastic Resection of Chest Wall* Gas and ether The abdomen was opened through a four-inch median epigastric incision A tumor was found involving the lesser curvature of the stomach and the cardia The tumor was fairly movable, but could not be brought into the field of operation It could be felt high up under the dome of the diaphragm but it could not be seen An incision was then made parallel to the free border of the ribs on the left side connecting with the median incision This incision was made with the view of doing an osteoplastic resection of the chest, as it was impossible to deliver the tumor into the wound or to tie off the gastrohepatic omentum The seventh, eighth and ninth ribs were exposed by blunt dissection and the cartilages of the seventh and eighth ribs were divided close to the sternum During this manipulation the pleura was injured and the opening at once closed by suture There was a striking improvement in the exposure of the tumor It could now be readily brought into the wound and freed from the gastrohepatic omentum by heavy catgut ligatures An assistant meanwhile made firm traction on the left chest wall, so that whereas before the division of the costal cartilages no one taking part in the operation was able to see the tumor, we were now able to examine it carefully and study its relations to the surrounding tissues Owing to the fact that the patient became very cyanotic and the pulse rapid and

feeble, it was deemed advisable to postpone further interference. Two gauze drains were inserted, one anterior and the other posterior to the tumor. The abdomen was closed with through and through silk sutures.

On the following day there was moderate subcutaneous emphysema of the chest wall. A day later the emphysema extended to both infra- and supraclavicular regions and upward on both sides of the neck. It then extended up over the left side of the face. The swelling produced by the emphysema was especially marked in the supraclavicular regions. On pressure the swelling could be very much reduced, but as soon as the pressure was removed, the swelling returned. It was not deemed safe to turn the patient to make a careful examination of the chest, but there were signs of air in the pleural cavity. Temperature, 102.4° F, pulse, 138, respiration, 38.

On July 7th the emphysema had extended to both sides of the face as far as the orbital regions, so that the facial expression was that of a nephritic. However the patient did not suffer any inconvenience therefrom. She complained a great deal of cough especially at night. The first dressing showed the pleural opening closed and the wound clean. Two weeks after operation there was a moderate pyocyaneus infection of the wound. The emphysema had become less marked. The daily vomiting which had been present before operation, persisted. On July 19th the emphysema had disappeared entirely from the left side and only a little remained on the right side in the infraclavicular region. The pyocyaneus wound infection was much less marked. Owing to the persistent vomiting it was not possible to improve the general condition, and there was a steady loss of weight. This was of course to be expected as the tumor in the stomach had not yet been removed. We were thus forced to do the secondary operation under unfavorable conditions.

Operation July 31, 1907. *Partial Gastrectomy. Resection of Œsophagus, Gastro-œsophagostomy.* No general anæsthetic was administered. A spinal injection of stovaine was given and eucaine was used locally. The former wound was opened and extended downward $2\frac{1}{2}$ inches. The general abdominal cavity was found well walled off by adhesions. The tumor was found to be in the lesser curvature of the stomach involving the lower end of the œsophagus. Some remaining strands of the gastro-

hepatic omentum were cut through and by means of blunt dissection and scissors the growth was isolated. A large V-shaped piece of the stomach, in the centre of which was the tumor, was excised, together with about $1\frac{1}{4}$ inches of the lower end of the œsophagus. The severed end of the stomach was caught with clamps and the field sponged dry of leaking gastric juice. Before cutting across the œsophagus two guide sutures of silk were passed into its wall to enable the pulling down of the cut end. The large opening in the stomach was closed with considerable difficulty owing to the adhesions from the previous operation. Several layers of Pagenstecher linen thread were used, the first one including all the coats of the stomach except the mucous membrane. After closing the opening completely, a new opening was made in the portion of the stomach nearest the severed end of the œsophagus. Into this small opening the end of the œsophagus was implanted and fastened in place with linen sutures. During the entire procedure the patient was fully conscious and did not complain of pain. She was now given a little water to see if the closure was perfect. Two points of leakage were seen and closed by suture. A packing was inserted down to the anastomosis, and the abdomen partly closed with through and through chromic gut sutures not including the skin. The specimen showed a growth 4 by 6 cm., very hard but showing no ulceration. Dr. Mandlebaum who made sections from the tumor pronounced it adenocarcinoma.

The immediate reaction from the operation was good. Nothing was given by mouth for seven days. Murphy infusion and stimulating enemata were well retained. Pulse and temperature were only slightly above normal during the first week following operation. During this time the wound discharge was very moderate and alkaline in reaction. On the eighth day a little water was given by mouth. The packings had been removed on the sixth day and fresh ones inserted. On the ninth day the patient drank water freely and it was noticed that there was a profuse watery discharge from the wound indicating leakage at the site of suture. On the eleventh day the condition suddenly became worse the pulse going up from 100 to 140 and the temperature from 99.6° to 104.4° F. Respiration became very much embarrassed and cyanosis marked. In spite of active stimulation the patient died eleven days after operation.

Abstract of the Wound Examination by Dr. Libman—The œsophagus had separated from the stomach by 2 cm, with sloughing at the free end. There was a large subphrenic abscess on the left side. The mediastinum and pleura were normal. There was no evidence of carcinoma, and no enlarged glands. There was fatty degeneration of the liver. The lungs showed passive congestion but no consolidation. A large healed cavity was found at the right apex. All of the stomach sutures had held and the suture line was water-tight.

So few operations of this kind have been done on the human subject that a careful analysis of each case is not only advisable but imperative. The shock of doing the entire operation under anæsthesia at one sitting is very great, and the resulting mortality would be too high. We have a choice of two alternatives, either we can do the operation under anæsthesia in two stages, or we can do one or both stages under spinal anæsthesia. Theoretically there is an objection to doing the operation at two sittings, adhesions that formed between the two steps of the operation might interfere with the secondary resection of the stomach. On the other hand the adhesions will partly wall off the rest of the peritoneal cavity and thus very much lessen the danger of a peritoneal infection. In our case we waited thirty days before doing the secondary operation, and although extensive adhesions had formed, they did not materially complicate the technic, and we had a feeling of security from the fact that the general cavity was partly shut off.

The first step in our operation was done under gas and ether, and the second step of the operation, the resection of stomach and œsophagus, under spinal anæsthesia. It was surprising how well the patient stood this second operation which took one and a half hours. During all this time she was fully conscious and was conversing with the operator and his assistants. At the close of the operation she declared she had had very little pain.

There is another advantage in using spinal anæsthesia. When we have completed our suturing of stomach and œsophagus the patient can be asked to swallow some water, and we can then detect any leak in the suture line. We took advan-

tage of this procedure in our case, and found two small openings in the suture line which were readily closed. And at the wound examination the suture line in the stomach was found water-tight.

A point in the technic of the utmost importance is the method of disposing of the open end of the œsophagus. If we resect an inch and a half or more of the œsophagus its cut end will not be covered by peritoneum. Even though we are able to bring down the œsophagus and suture it into the stomach without tension, the chance of getting a good union is minimized by the absence of peritoneum over the end of the œsophagus. In animal experimentation there is not so much difficulty in getting a good union between stomach and œsophagus. But in the human subject as is well known the success of all anastomoses in the gastro-intestinal tract depends on good union of the serous surfaces. Where the serosa is absent, as in the second portion of the duodenum and the lower portions of the rectum, we are very apt to have leakage. And that is what unfortunately happened in our case. Although we were able to bring down the cut end of the œsophagus and suture it without tension into the newly-made opening of the stomach which was drawn well up under the diaphragm, the sutures did not hold. There was leakage, followed by a subphrenic abscess, which caused the death of the patient. On the other hand every single suture employed in the wall of the stomach held securely for eleven days until the patient's death, because here we had good serosa in our suture line.

How else can we deal with the cut end of the œsophagus? We can sew it up completely and do a gastrostomy or a jejunostomy, or we can make an œsophageal fistula at the root of the neck, bringing out the cut end of the œsophagus and suturing it to the skin of the neck. This could, if necessary, be done at a subsequent sitting, thus dividing the operation into two or three steps. Had either of these methods of dealing with the end of the œsophagus been carried out in our case, we believe the patient would have had an excellent chance to re-

cover So that this point in the technic is really of vital import

The objection to closing the œsophagus completely is that fluids from the mouth would run down and cause trouble This objection would be overcome by making an œsophageal fistula in the neck

We do not wish to claim originality for this step but, so far as we have been able to search the literature, we have nowhere found this suggestion either made or carried out

The steps of the complete operation, which could be divided into two or three sittings, would then be

First Operation —Osteoplastic resection of costal arch, either through an incision parallel to the free border of the ribs, or through a median and cross incision

Second Operation —Resection of stomach and œsophagus, and gastrostomy or jejunostomy

Third Operation —Æsophagostomy at the root of the neck

The idea of doing an œsophagostomy instead of attempting to suture the œsophagus to the stomach occurred to the writer from its analogy to doing a colostomy after excision of the rectum The writer is aware that Sauerbruch, in his animal experimentation, obtained better union between œsophagus and stomach by the button than by suture His suture cases all leaked However, we can hardly, in the human subject, expect to get a watertight, permanent union by the button Indeed, judging from the use of the button in intestinal work, we could not expect as good results as from sutures

Furthermore, at the present time, when even the question of doing intrathoracic operations under positive or negative pressure is still *sub judice*, the operation which the writer has suggested would seem to have a field of usefulness And it must also be admitted that intrathoracic operations are much more shocking than intraperitoneal operations And finally, if we determine not to bring down the œsophagus, we can resect it at a higher level and thus get further away from the diseased focus.

BIBLIOGRAPHY

- Micheli Report Tenth Italian Congress of Surgeons, 1895
Gottstein Technik u Klinik d Oesophagoskopie, Mitteil aus den Greuz-
gebieten, etc, 1901, p 57
Kelling Becken-Hangelage bei horizontalem Rumpf fur Operationen in
d Nahe d Zwerchfells, Centralbl f Chir, 1901, 1025
Kelling Technische Beitrage zur Chirurgie d Bauchhohle, Centralbl f
Chir, 1904, p 89
Marwedel Die Aufklappung des Rippenbogens zur Erleichterung opera-
tiver Eingriffe, etc, Centralbl f Chir, 1903, p 938
Asthoewer Centralbl f Chir, 1903, p 1257
Willy Meyer Osteoplastic Resection of the Costal Arch, etc, Jour Amer
Med Assoc, Oct 6, 1906

NOTES ON THE ARREST OF HEPATIC HEMORRHAGE DUE TO TRAUMA.

BY J. HOGARTH PRINGLE, F R C S,

OF GLASGOW,

Lecturer on Surgery in Queen Margaret College, Surgeon to the Glasgow Royal Infirmary

RUPTURE of the liver is fortunately an accident not often met with, but one which, when it is seen, may be associated with a condition of the patient as serious as any one can meet with in surgical practice. While small lacerations of the liver substance may be, and, no doubt are, recovered from without surgical interference, if the laceration be extensive and vessels of any magnitude are torn, hemorrhage will, owing to the structural arrangement of the liver, go on continuously, and by the time such a patient comes under the care of a surgeon the general state is almost invariably bound to be extremely grave, from the hemorrhage alone or from hemorrhage and shock combined, and this is perhaps specially the case in that class of injury due to contusing violence in which there is often gross injury inflicted on parts other than the liver and when shock is liable to be more severe than in localized injuries caused by sharp instruments.

The statistics collected by Terrier and Auvray show that wounds of the liver from contusing violence are much more fatal than localized cutting injuries for out of 44 patients operated upon for wounds of the liver caused by sharp instruments there were 7 deaths, whereas out of 23 patients operated on for wounds due to contusing violence there were 9 deaths.

During the last eleven years there have been eight patients admitted to my service at the Glasgow Royal Infirmary, who had sustained a rupture of the liver. Three of these patients suffering from the effects of gross traumatism died almost

immediately after admission to the hospital Post-mortem examinations were made in these three cases, and in one of them it was found the liver had been torn completely into two halves along the longitudinal fissure, in another there was, in addition to an extensive laceration of the liver, a widespread fracturing of the base of the skull, with laceration of the brain and a fracture of the right femur In the third, there was a dislocation of the knee along with fractures of the left fibula, right humerus and several of the right ribs, with a wound of the right lung as well as the liver injury The condition of each of these patients was hopeless from the beginning The other five patients survived their injury, so far as to enable an extended examination to be made, and on four occasions it was determined to open the abdomen upon the assumption that the patient had a rupture of the liver, in the hope that it might be possible to arrest the bleeding and perhaps save the patient, but the results were anything but gratifying, for all four patients died and two of them before their operation was completed The remaining patient steadily refused operation and died on the third day after his injury

In the case of the first patient, upon whom I operated, the abdominal cavity was not only found to contain a very large amount of blood, but as soon as the peritoneum was opened blood welled up in large quantities from an extensive laceration of the right lobe of the liver, and before anything could be done to arrest it the patient had died, not from the blood lost prior to the operation but from the profuse and uncontrolled hemorrhage that took place from the torn surfaces of the liver after the peritoneum was opened and the tension inside the abdomen released Later it occurred to me that if the portal vein had been compressed in the anterior boundary of the foramen of Winslow the hemorrhage might have been so far temporarily arrested as to permit a thorough treatment of the torn vessels

My second operation case came shortly after the first and after opening the abdomen an assistant held the portal vein and the hepatic artery between a finger and thumb and

completely arrested all bleeding, and we got on a little further in consequence of being able to wipe out blood and blood clot and to examine the rupture, several silk ligatures were passed and drawn up and some packing applied round the seat of the wound, but the patient died in spite of it, very soon after the operation was completed

I had, in the interval between the occurrence of these two cases convinced myself, after observations carried out in the post-mortem room, that a completely satisfactory and tolerably easy method of arresting hemorrhage was probably to be obtained by passing ligatures through the liver substance at a sufficient distance from the margins of the wound to make certain they would not slip, and by pulling these up as tight as possible, allowing them to cut completely into the liver tissue, the coats of the vessels in the liver are sufficiently resistant to permit this to be done without giving way themselves. After this, if one obstructs the inferior vena cava and then forces fluid through the portal vein, it will be found that practically no escape will take place from a cut surface in the liver, even though the pressure of the fluid be very much greater than that of the portal blood stream in life—if any does come away, it is the merest ooze, and in actual practice any oozing of blood of this nature and degree could always, I believe, be controlled by packing

This is the method originally described by Kusnetzoff and Pensky which I only learned after reading the very admirable paper of Anschutz, on Resection of the Liver. Kusnetzoff devised some special needles for passing the sutures—blunt-pointed and short with varying curves. I used a handled needle of soft steel which could be variously curved as required and an improved model was made for me by Messrs Baird Bros, Glasgow, which has proved quite efficient in these cases

As far as my experience goes it is quite as easy to work with this suture as it is to employ the method of compressing the margins of the liver wound with such things as strips of whalebone as suggested by Cecherelli and Bianchi—or with

the articulated support of Segale—or the strips of magnesium metal more recently suggested by Payr and Martina, for each of these contrivances requires the use of sutures in the liver to hold it in position, and while magnesium may, as is claimed for it, be absorbed, it is quite probable that the whale-bone or ivory strips, even though decalcified, might ultimately have to be removed. I do not believe these forms of apparatus will have any permanent place in the surgery of the liver but that they will disappear just as the bobbins, etc., have disappeared or are disappearing in the surgery of the gastrointestinal canal.

When I began to look into the subject of the treatment of injuries to the liver and the arrest of hepatic hemorrhage it came as rather a surprise to find it stated in Langenbuch's volume, in the "*Deutsche Chirurgie*," on the Surgery of the Liver, that Ponfick and others had had such disastrous results from obstructing the hepatic and portal vessels in their experimental animals. I have not seen the original papers, but Langenbuch states that death of the animal occurred almost "at once from collapse" in some instances or "within a few hours" in others apparently owing to stagnation of blood in the portal area. I have some difficulty in understanding why an animal should necessarily die under such circumstances as rapidly as is stated to have been the case in these experiments, though, if the interference with the portal vein had been so long continued as to affect the vitality of the coats of the bowel it would lead to gangrene and peritonitis, but in that case death would not be immediate. At any rate, the method had afforded me such decided advantages at the time in the only case in which I had till then employed it, although the patient did not survive, and he certainly did not die because his portal vein had been obstructed, that it seemed it might be worth while to endeavor to determine the effect by experiment again. This I was enabled to do several years ago in the Pathological Institute in Vienna and I desire now to express my thanks to the Director, Hofrath Professor Weichselbaum, for the privileges so kindly afforded me there.

In my experiments I employed rabbits as Ponfick had previously done. The animals were anæsthetized with chloroform, the abdomen opened and the portal vessels clamped with a narrow pressure forceps, the blades of which were covered with rubber tubing. The first animal, a large buck rabbit, was kept in full anæsthesia for one hour after the clamp was applied to the vessels and during this time the surface of one of the lobes of the liver was freely cut into at several places but no bleeding followed, at the end of one hour this lobe was cut off and *then* the ligatures were passed through the stump and tied and after that the clamp was removed, but no blood escaped from the cut surface during the time that elapsed between the amputation of the lobe and the passing and tying of the ligatures, hemorrhage had been controlled as perfectly as could be desired. As far as the intestines were concerned the only change that had occurred by the end of the hour was that in color they were possibly a little darker than they had been when the abdomen was first opened, but even this was comparatively slight.

Three other animals were treated in the same way, but the clamp was only kept on the portal vessels long enough to permit the amputation of one of the liver lobes which was always done *before* passing the ligatures through the stump. Hemorrhage was completely controlled in all of them and no obvious change occurred in the appearance of the intestines. Moreover, all four animals recovered from the operation, fed well and developed no abnormal symptom, and, as the time at my disposal was short, were killed on the third or fourth day after the operations, but beyond recent adhesions round the cut and ligatured stump of the liver nothing abnormal was found on post-mortem examination in any one of them. It was not considered necessary, therefore, to continue the experiments over a greater number of animals, for their object seemed to have been attained. The animals survived the temporary obstruction of their portal circulation and did not appear to have been in any way injured by it.

Since these experiments were made two patients with rup-

ture of the liver have been operated upon by me, and in each case the hepatic and portal vessels were grasped between fingers and thumb as soon as the abdomen was opened, while blood clot, etc., was cleared out of the abdominal cavity and the necessary manipulations were being carried out on the liver. In both cases the method acted admirably, perfect control of the bleeding areas of the liver was obtained and a clear field for operating. Of these two patients the first to be operated upon died before the operation was completed. To the second of them I shall refer immediately.

A suggestion was made by Ponfick and it is spoken of with favor by Langenbuch, regarding the possibility of avoiding the dangerous congestion of the intestines which followed on obstruction to the portal circulation, and it is this, that the superior and inferior mesenteric arteries should be tied (temporarily) in the first place and then the portal vein obstructed, but it appears to me as the result of my experience with the experimental animals as well as in the case of three patients that this is not necessary. The time that would be required to tie the mesenteric arteries must be taken into account, for in the case of such patients with a degree of shock present that is always great and often extreme and moreover who are suffering from great loss of blood, time in the operation is a consideration of the first importance.

The proposal of these writers with regard to the freeing of the liver from its attachments to the diaphragm and posterior abdominal wall is, however, one of great value and would appear to offer considerable possibilities to a surgeon. For in these cases, after the further occurrence of hemorrhage has been prevented by holding the main vessels, and the field of operation has been cleared of blood, the difficulty of obtaining access to a wound situated far back upon the upper or lower surface and particularly the upper surface of the large right lobe of the liver is very great, and it will occasionally prove to be impossible unless more open access can be obtained. This, however, can be obtained in one of two ways, either (1) by dividing the coronary and right lateral ligaments

of the liver and thereby freeing it so as to allow the liver to be dislocated and delivered up to the abdominal wound as was originally suggested by Langenbuch, or, as I think (2), by freeing a portion of the lower thoracic wall by dividing the ribs and holding up this flap of ribs and diaphragm. I do not know whether either method has ever been employed in actual practice, the latter is possibly the more severe of the two, but it might be quicker to carry it out and it might, in consequence, save time.

The difficulty in such a case is to some extent illustrated by that of the last patient upon whom I operated. This man had symptoms pointing to rupture both of the liver and of the right kidney. I opened the abdomen first and could easily feel the liver wound situated on the right lobe, just in front of the upper layer of the coronary ligament, as far as the introduction of ligatures was concerned it was entirely inaccessible and I considered the question of making a thoracic flap or of dividing the ligaments to get access to it, but decided for the latter as it was necessary to explore the kidney from the loin and the possibility of urine escaping from the wound had to be kept in mind. In trying to carry out this division of the ligaments it proved an extremely difficult matter to get at them, in spite of the large perirenal hæmatoma which tended to project the liver forwards, for with the longest (8 inches) scissors available I could only reach and divide the lateral ligament. The convexity of the upper surface of the liver itself appeared to be the chief obstacle to getting at the coronary ligament, but having got the lateral ligament divided it was found possible, by traction and pressure, etc., to tear the upper layer of the coronary ligament, although this succeeded to some extent it quickly became apparent that the rupture in the liver tissue was being considerably enlarged by the manoeuvre and it became necessary in consequence of this to desist from further attempts in this direction. I had to finish by packing the suprahepatic space which, as it turned out, acted very well, for very little hemorrhage took place after this the right kidney, was then exposed from behind and a large extravasation of blood there evacuated and the perinephritic space was packed also, for although the kidney was extensively ruptured it was thought the patient's chance of life would be diminished by

a nephrectomy at that time. He carried on well for two days and then developed signs of consolidation of the right lung and died on the fourth day after his accident and operation. At the post-mortem examination it was found that practically no further bleeding had occurred from the extensive rupture of the liver and none from the kidney and there was no peritonitis, but the right lung was in an early stage of gangrene, due, doubtless to embolism. It has been shown in the experimental work that embolism of the pulmonary vessels consequent upon thrombosis of the liver vessels is as common as it is fatal.

A question of some importance, in these cases, arises as to the time when operation should be carried out. One of my patients lived for three days after his injury, and although it was believed he had a rupture of the liver and operation was repeatedly urged upon him, he persistently refused to submit to it. He died with symptoms pointing to intestinal obstruction, viz., constipation and fecal vomiting, and at the post-mortem examination it was found that the abdominal cavity contained a very large amount of blood and there was a rupture of the liver far back against the coronary ligament which would certainly have been difficult of access for the purpose of applying ligatures to the torn liver vessels. But the liver wound was full of ante-mortem clot, the tendency to hemorrhage had been spontaneously arrested, and if the abdominal cavity had been emptied of blood and the region of the liver injury merely packed, the patient might have got through.

The mere act of opening the abdomen, in some, at any rate, of these cases is, I feel certain, associated with an increase of the amount of blood that is lost to the patient. The blood pressure in the portal vein is not great and as the result of the local injury and the extravasation of blood there is produced reflexly a state of firm contraction of the abdominal muscles. The abdominal wall in these cases becomes absolutely rigid and board-like, the tension in the abdominal cavity thereby brought about must prevent at least a rapid escape of blood and may lead to its arrest altogether. No patient could survive the sort of hemorrhage that occurred on

opening the abdomen of my first patient from the liver itself—not the mere escape of the blood already extravasated into the peritoneal cavity—for more than a few minutes, in fact, this patient died immediately as the result of this hemorrhage. It would have been impossible to have got such a patient transported to hospital alive, had it not been that the hemorrhage had been delayed in the manner suggested.

It is very probable that slight ruptures will occasionally heal without surgical interference in consequence of this increased tension of the abdominal wall leading to the arrest of hemorrhage, but in the cases of severe injury to the liver this will not happen, many patients if left without surgical aid, will die from hemorrhage or shock in the first place, or if they get over these dangers will succumb later from intestinal obstruction and peritonitis, when the extravasated blood becomes infected from the bowel, of which it has every chance, if such a patient hold on long enough. So that if these severe cases are to be got through at all, I feel that operation must be an immediate one for the majority, and that some of these patients can be saved is well seen from Terrier and Auvray's figures.

It is a most unhappy calamity that a patient, whose life one is endeavoring to save, should die before an operation is completed, but it is a risk that has occasionally to be faced and in these cases of injury to the liver, one is most likely to avoid it, I believe, by rapidity of operating, and this will be favored by the immediate arrest of the active hemorrhage that is going on, by seizing the portal vessels as soon as the abdominal cavity is opened, for by so doing one can obtain a clear field and therefore time is gained for the treatment of the wound of the liver itself.

The permanent arrest of hepatic hemorrhage is, in my opinion, best effected by ligation of the liver tissue in mass in every case where that is possible, but in some cases it may not be practicable and then we will have to rely solely upon packing.

CAUSE OF SUDDEN FALL IN BLOOD-PRESSURE WHILE EXPLORING THE COMMON BILE-DUCT

BY J LOUIS RANSOHOFF, M D,

OF CINCINNATI, OHIO,

THE essential feature or symptom of shock is a fall in blood-pressure, which may be due to one or many causes. Recent experiments, particularly by Crile, have shown that in most cases shock is due to vasomotor paralysis from excessive nervous stimulation. Shock in abdominal operations is more marked in the upper regions of the abdomen, increasing as the diaphragm is approached. Mayo has noticed the great liability to shock in operations and manipulations of the common duct. All operators of any experience agree that during these operations the pulse may suddenly become rapid and small, and the respiration shallow and frequent. These symptoms have been attributed to a temporary vasomotor paralysis due to excessive insult to the great splanchnic plexus of sympathetic nerves.

We began this series of experiments with the preformed idea that these symptoms were dependent on the overstimulation and insults to the sympathetic nerves, but we soon learned that our premises were wrong. Rabbits of a uniform size were the subjects of these experiments. They were in all cases anæsthetized with ether before beginning the operation. Under complete anæsthesia the trachea was exposed and the breathing cannula inserted. This was connected with a bottle and the anæsthetic continued in this way. The carotid was then exposed and a glass cannula introduced connected with a Hurthle manometer. The records were taken on smoked paper on a revolving drum of the Porter model.

* From the Physiological Laboratory of the Medical College of Ohio,
University of Cincinnati

Respirations were not recorded as the apparatus markedly interfered with carrying on the experiment. Twenty-five experiments were made in all.

In the earlier experiments, various manipulations were made in the region of the pylorus, the duodenum and the common duct. These manipulations had no effect on the blood-pressure, with the exception of a slight and gradual fall. The manipulations were made as follows:

- 1 Opening of the abdomen, resulted in a very slight fall with a quick return to the normal pressure
- 2 Traction on the gall-bladder, no effect
- 3 Traction on the pylorus and thus on the gastrohepatic
 - a Traction in a pedad direction, no effect
 - b Traction in a ventrad direction, slight fall

Although difficult to prove, it seems from subsequent experiments, that the fall in blood-pressure in ventrad traction of the gastrohepatic omentum is due to a slight kink of the portal vein and interference with the return flow.

- 4 Vigorous sponging in this region resulted in a slight and gradual fall.

In the second series of experiments, the pylorus was isolated and the tip of the small finger was introduced into the foramen of Winslow. Care was taken that no pressure was made on the vena cava. In each case at the instant of introduction of the finger into the foramen of Winslow, a sudden and marked fall of blood-pressure with rapid and small pulse was noticed. The fall ranged from twenty to forty millimetres of mercury. The blood-pressure continued at this low ebb as long as the finger was held in the foramen. As soon as the finger was removed, the blood-pressure arose to its previous level. The results in these experiments were absolutely constant. For example experiment No. 12.

Full-grown rabbit in good condition, ether anæsthesia, tracheal breathing cannula and cannula in carotid. Initial blood-pressure 80 mm of mercury. Abdomen opened in epigastric region, pressure 75 mm. The tip of the little finger was now introduced into the foramen of Winslow and held there ten seconds. Blood pressure, 40 mm. The finger was now removed and the blood mounted to 80 mm. After allowing the blood-

pressure to regain its normal level, the finger was again introduced into the foramen and held in place for twelve seconds, with a resulting fall to 40 mm. After removing the finger the pressure rose rapidly to 80 mm. This manoeuvre was repeated several times with like result, the animal then killed. The accompanying tracing (Fig 1) showed the experiment in detail.

In another experiment, a hook was introduced into the foramen of Winslow and upward traction was made with the same result as in the preceding experiment. This was done to make sure that no pressure had been made upon the vena cava.

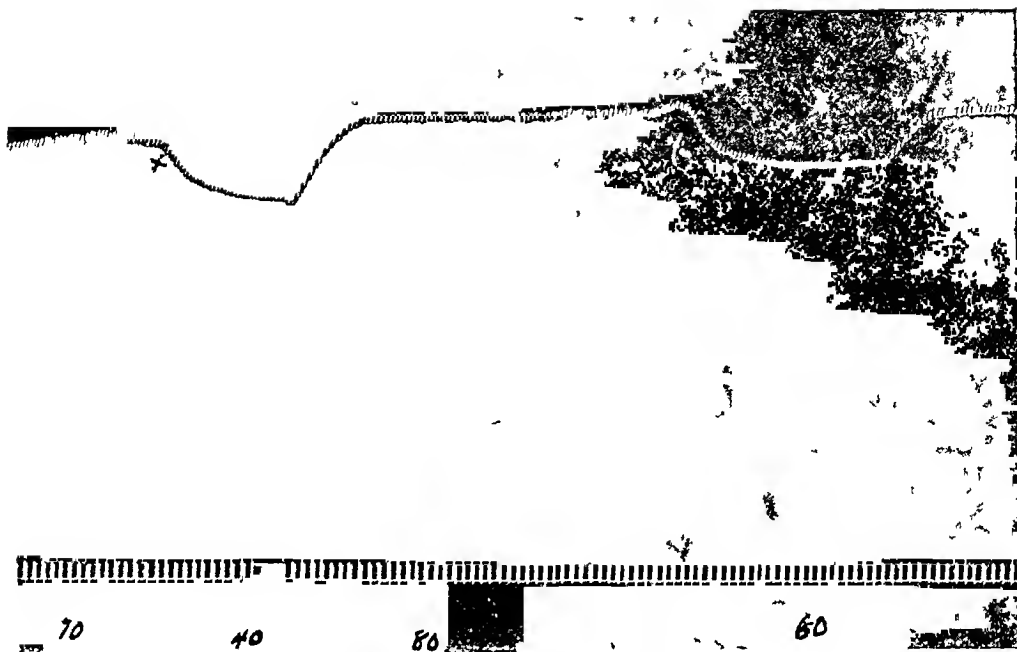
A series of control experiments was now made. The gastrohepatic omentum was now exposed and the portal vein was isolated as far as possible. The vein was now temporarily clipped and the same drop in blood-pressure was noted, except that the drop was more marked.

Experiment 15. Full-grown rabbit, ether anaesthesia, tracheal breathing cannula, cannula in carotid artery, pressure, 105 mm. The portal vein was now exposed, during which manipulation slight variation in blood-pressure was noted. A temporary clip was now applied and left in place for twenty-two seconds. The blood-pressure fell to 50 mm. The clip was now removed and the pressure gradually rose to 100 mm. The animal was then killed. The accompanying tracing (Fig 2) is a graphic record of this experiment.

Control experiments were now made in the operating room on human subjects, and in each case the same result was obtained. The Recklinghausen tonometer was used. The following is typical of the results obtained.

Mrs S, aged 40. Diagnosis: Stone in common duct. Operation at Jewish Hospital by Dr Joseph Ransohoff, November 27, 1907. Gas-ether anaesthesia, initial blood-pressure 110 mm. Abdomen opened, pressure dropped to 105 mm. Gall-bladder freed from adhesions, no change in blood pressure. Finger introduced into foramen of Winslow in search of stone in common duct, and resulted in a prompt fall of the blood-pressure to 70 mm. Finger removed and blood-pressure rose to 105 mm. During the subsequent course of the operation, this manoeuvre was repeated with like result (see Fig 3). The stone was found in the common duct, and the operation concluded with hepatic drainage.

FIG 1



Tracing of experiment No 12

FIG 2



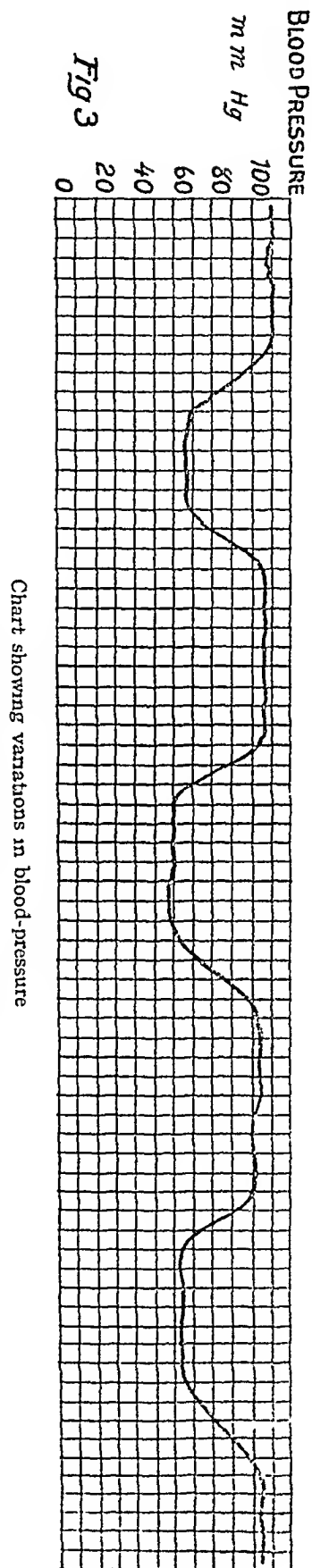
Tracing of experiment No 13



It will be seen from these observations that the marked fall in blood-pressure occurred when the common duct was explored by introducing the finger into the foramen of Winslow. In this manipulation the structures in the gastrohepatic omentum are lifted in the crook of the exploring finger and inadvertently the portal vein is compressed. This partially closes its lumen, resulting in the shutting off of a great quantity of blood from the general circulation and the consequent lowering of blood-pressure. That the fall of blood-pressure occurs at the instant of the introduction of the finger into the foramen of Winslow, and in every case remains at the low level while the finger is held in place. The fall of blood-pressure is due entirely to pressure on the portal vein is conclusively shown by experiment 15, in which the portal vein was clamped and an immediate fall occurred.

Knowing as we do the results of this pressure on the portal vein, I think that the digital exploration of the common duct should be intermitted at short intervals to allow the circulation to regain its normal tone.

I am indebted to Dr Edward Baehr, director of the laboratory, for his valuable suggestions and kind assistance.



A METHOD TO FACILITATE THE AVOIDANCE OF INFECTION DURING INTESTINAL ANASTOMOSIS—PRELIMINARY REPORT

BY J HALPENNY, M D,

OF WINNIPEG, MANITOBA,

From the Physiological Laboratory, University of Manitoba

IN the early attempts at securing union of divided intestine the chief difficulty was probably found to be in suturing, so that the continuity of the bowel was preserved. In order to meet this difficulty there arose many mechanical devices used largely in end-to-end union. Different stages of development of these mechanical aids may be traced until the climax was probably reached when J B Murphy perfected the button known by his name. Not content, however, with this improved method, the efforts of surgeons were exerted towards doing away with mechanical aids altogether, and the Connell stitch in end-to-end union has accomplished this very well.

During the years covered by this progressive development many surgeons were using lateral anastomosis because the stitching is more easily carried out without any mechanical aid than in end-to-end union. At the present time some surgeons prefer the end-to-end or end-to-side method in practically all cases. Others, however, prefer lateral anastomosis in many cases. Mayo¹ says, "Lateral anastomosis, with end-to-end closure by the two-row suture method, we believe to be the safe resection for *acute* obstruction of the small intestine.

After resection for chronic obstruction of the small intestine end-to-end union is the operation of choice.

The ileocolic anastomosis should be lateral.

In resecting part of the transverse colon, end-to-end or lateral anastomosis may be performed. The Murphy button should

* Read before the Scientific Club, Winnipeg, April 7, 1907.

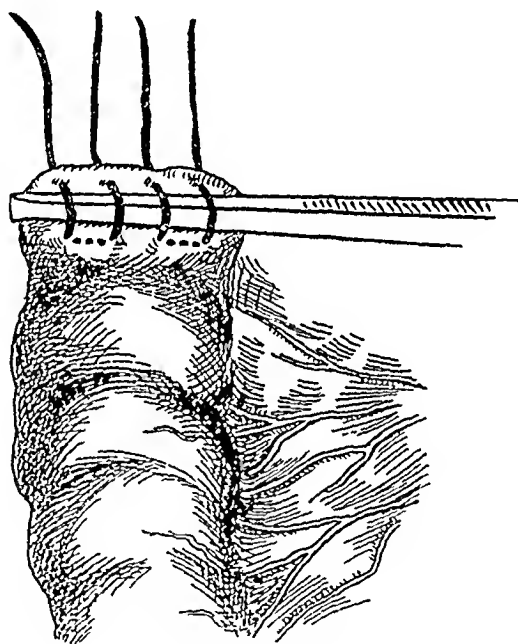
¹ Transactions Surgical Section American Medical Association, 1907.

be avoided, as there may be fecal masses of sufficient size to obstruct the lumen of the bowel ”

This may be taken as a fair expression of the choice of methods, and it shows that lateral union is preferred by surgeons in many cases. Physiological workers such as Cannon, however, prefer end-to-end union because the immediate functional results are said to be better than after the lateral

One of the difficulties in lateral anastomosis is that of avoiding infection of the field of operation at the time the

FIG 1



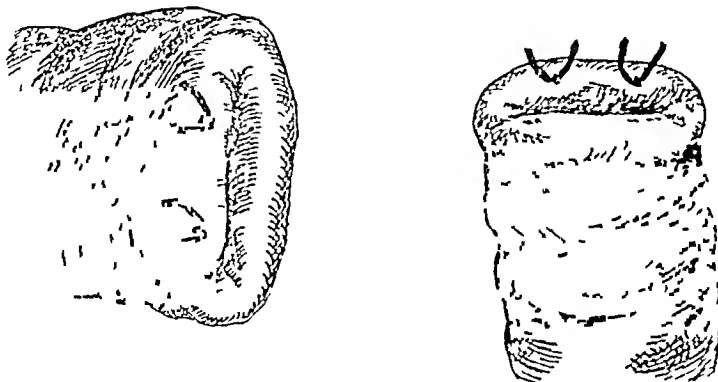
Inversion of cut ends of intestine

artificial opening is made and before it is inclosed by suture. It was to overcome this difficulty that the operation here described was devised and tested.

The mesentery is treated in the usual way. The cut ends of the intestine are inverted by two Halsted stitches (Figs 1 and 2). The intestine is lapped about four inches and a continuous silk suture fastens the two limbs together by going up just alongside the centre opposite to the mesentery, and back again just as far from the centre of the intestine as the former line of suture and on the opposite side (Fig 3).

The knife (Fig 4) is now inserted as shown (Fig 5), entering the lumen of the bowel near one end of the intestine, and with the blade parallel to the circular fibres. It is passed

FIG 2



Cut end of intestine after inversion

along the lumen of the bowel as far as the shank will allow (Fig 6) and the artificial opening is made through the two

FIG 3



Lapping of the two sections of intestine

layers of bowel by cutting back (Fig 7). A purse-string suture is now placed about the knife, and, the knife being withdrawn, the hole is closed (Fig 8).

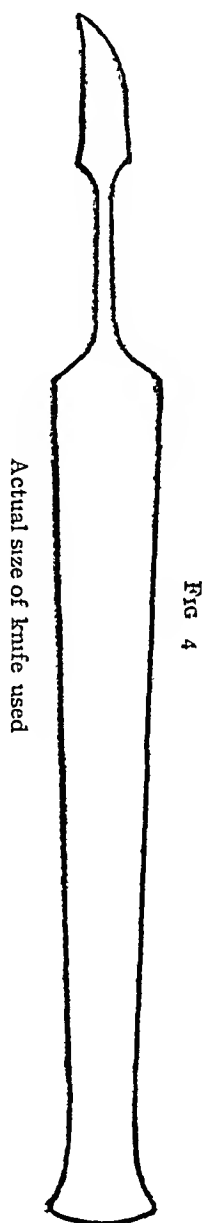
The knife (Fig 4) is made with a narrow, short blade and a long shank. The blade makes a very small hole, and the long shank allows the knife to pass up far enough in the intestine to make an opening sufficiently large. There is no danger of cutting the stitches, neither is there any danger of cutting too deeply. Sensation guides one in this.

One objection to this incision is that bleeding may occur, because the cut edges are not sewn over. I have found no difficulty arise from this in the few dogs I have operated on.

Up to the present my operation has been performed exclusively on dogs. So far I have operated on six and in only one of these has a fatal result supervened. This one was a very small puppy, the intestine, when flattened, measuring only one-half inch. Death was caused by gangrene of the bowel due to the stitches cutting off the circular vessels. The mesenteric circulation was not interfered with, neither was there any peritonitis. At the postmortem the artificial opening was larger than the lumen of the bowel.

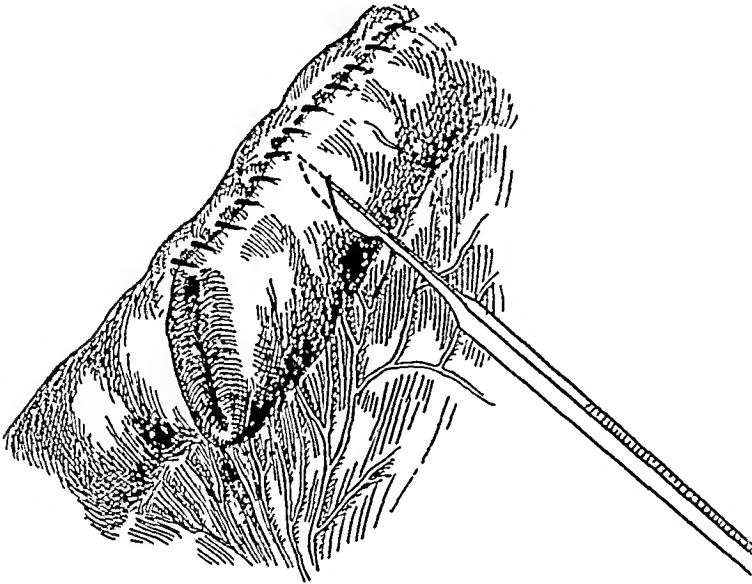
The dogs were fed and watered as usual from the day of the operation. No blood was passed in the stool of any one of the six. Owing to the limited amount of space for housing animals the average length of time they were kept was only nineteen days, but with one exception besides the fatal case the animals seemed as well as ever. In that case there was not a large enough opening and the nutrition of the animal suffered somewhat before he was sacrificed. This case was operated on before I got the special knife made.

In no case was there any sign of peritoneal infection.



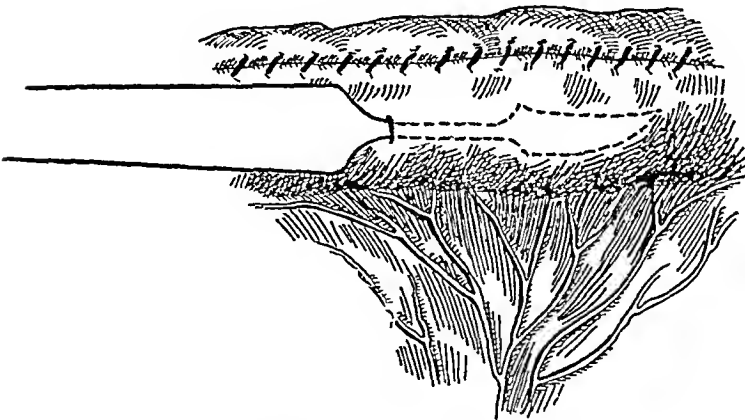
One dog had a stitch abscess in the abdominal wall, but in all the others the wound healed by first intention

FIG 5



Inserting knife

FIG 6.



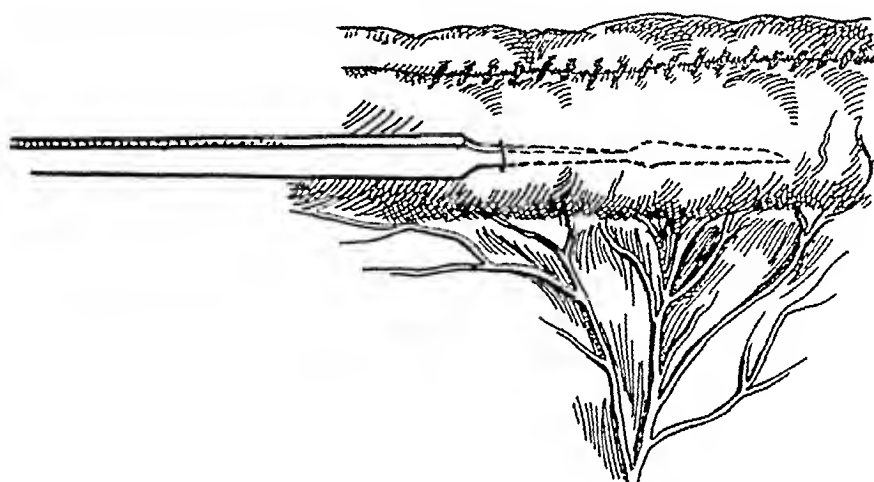
Knife introduced as far as shank will admit

It is my intention to continue the series of operations, and to vary the procedure in regard both to the length of the

intestine removed and to the anatomical situation of the resection.

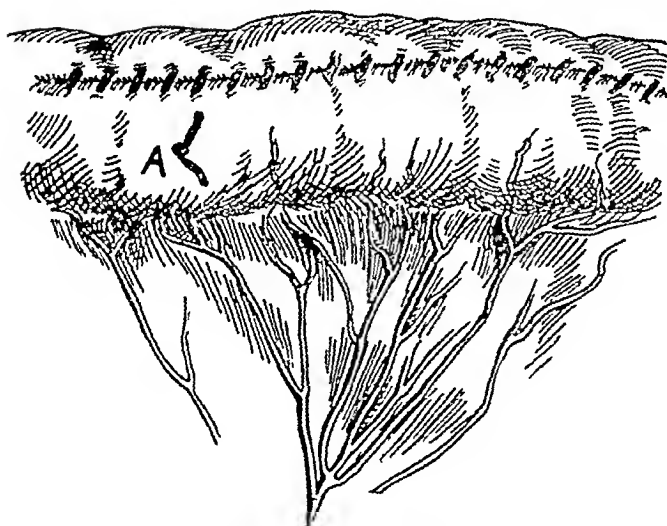
If the operation I have described can be carried out in dogs with results approximating to uniformity, I shall have no hesi-

FIG 7.



Knife in position for cutting

FIG 8



A Knot after removal of knife

tation in adopting the method in the case of the human intestine

PRIMARY CARCINOMA OF THE APPENDIX.

REPORT OF TWO CASES

BY A E GARROW, M D, AND C B KEENAN, M D,

OF MONTREAL,

Assistant Surgeons, Royal Victoria Hospital

CASE I—Miss E Y, aged 21, was admitted to the Royal Victoria Hospital on October 1, 1906, complaining of pain in the right lower quadrant of the abdomen. Seven years ago she had for a short period what she calls a "dead soreness" in this region, which was aggravated or brought on by over-exertion. She frequently complained of pain in this side when menstruating, otherwise her general health has been good. Four weeks ago, however, she had an unusually severe attack of pain, accompanied by vomiting, necessitating her confinement to bed at that time for a day or two, and since then she has had in all five similar attacks. In the intervals she was free from pain but there was an abiding tenderness on pressure in the right side. Examination on admission revealed some tenderness to pressure at or about McBurney's point, and a small tender mass could be palpated two finger-breadths below a line running from the umbilicus to the anterior superior iliac spine.

On October 4th incision revealed a slightly adherent appendix, constricted three quarters of an inch from the base and very much distended at its distal portion. There was little evidence of peritoneal inflammation old or recent. The patient made an uninterrupted recovery and from the last report has remained well.

Section of the appendix showed complete occlusion for about one inch, the distended and thinned out terminal part containing clear mucoid material. At the operation this was regarded as a typical example of obliterating appendicitis and I am indebted to Dr Keenan for the opportunity for adding another case of primary carcinoma of the appendix to the rapidly increasing number of such cases now recorded.

Microscopical examination showed that the occluding mass was not an inflammatory nodule, but a cubical-celled carcinoma

infiltrating all the coats of the appendix. But for the routine examination of all morbid material in the surgical clinic this case would have passed unrecognized. I am indebted to Dr Mackey of Grenville, who sent the patient to the Hospital, for the opportunity of securing the specimen.

CASE II—The second patient, I F, a girl aged 13, was admitted to the Royal Victoria Hospital on March 19, 1907, complaining of pain and tenderness in the right iliac region. Dr Harwood of Malone who had charge of the patient previously, stated that on March 13th she had been suddenly seized with severe pain in the right iliac region with nausea and vomiting. Extreme tenderness soon developed in the appendix region associated with an increased pulse-rate and moderate fever.

When admitted the patient's condition strongly suggested a perforated appendix with localized peritonitis and she was operated on immediately. The appendix was found lying over the brim of the pelvis, which latter was filled with pus. On freeing the appendix from very slight adhesions its distal third was found dark, almost gangrenous, and distended, measuring one inch in diameter and showing a small perforation. The proximal two-thirds exhibited slight congestion of the serosa only.

Examination of the removed appendix showed a small new growth blocking the lumen just proximal to the swollen portion and this latter consisted of a distended gangrenous appendix well filled with pus. Sections of this growth showed it to be a small cubical-celled carcinoma markedly resembling a rodent ulcer. The greater portion of the mass projected into the lumen, but it also invaded the muscular coats and a few groups of the tumor cells lay just beneath the serosa. The small cubical cells of the tumor were quite distinct in type from the tall columnar cells lining the remaining lumen of the appendix and transition forms could not be found.

The patient made an uneventful recovery and at the present time, a year later, is in perfect health.

Until quite recently carcinoma of the appendix, unless secondary to cæcal cancer, has not been recognized or recorded except in a very few instances. In late years systematic examination of all appendices removed has revealed the fact that primary carcinoma of the appendix is not a rare condi-

tion, for the above two, with those previously recorded make eighty-four cases of primary carcinoma of this organ

It is interesting to note that most if not all of these cases were diagnosed only when the nodule was sectioned. This is true of our two cases and they both illustrate well one type of the so-called "primary carcinoma" of the appendix, occurring as it so frequently does in young people, Brandts¹ having reported such a case in a seven-year-old boy and Zaaier² another in a girl of twelve. Vassmer,³ in a recent communication, has stated that such growths do not give rise to any symptoms until appendicitis develops, and believes that the nodule is indirectly responsible for the onset of the inflammatory symptoms. Cases are recorded, however, where such growths were discovered quite accidentally on the post-mortem table, or where laparotomy had been performed for some other condition.

A careful histological study of our two specimens shows that the new growths originated in the submucosa, possibly from embryonic rests, for the small cubical cells composing the growths are quite distinct and apart from the tall columnar cells lining the remaining lumen of the organ.

Some pathologists have termed these nodules "endotheliomata." We must regard such growths as carcinoma in spite of their small size, slow growth, not recurring when the appendix is removed, nor giving rise to metastases, while, as already pointed out, they infiltrate contiguous tissues.

¹ Brandts Munch med Woch, 1907, s 1780

² Zaaier v Brunnsche Betrage z klin Chir, Bd 54, H 2, s 239

³ Vassmer Deutsche Zeit f Chir, Bd 91, s 445, 1908

CARCINOMA OF THE APPENDIX VERMIFORMIS.

BY GEORGE H MONKS, M D,

OF BOSTON, MASS.,

Surgeon to the Boston City Hospital

CASE I—*Appendectomy for chronic appendicitis, a carcinoma found by the pathologist within the chronically inflamed appendix, rapid convalescence of the patient, the patient in perfect health about 5½ years after operation*

X Y, a housemaid, a strong and well-built woman, 24 years old, who had previously been troubled more or less with indigestion for an indefinite period, entered the Boston City Hospital in September, 1902, with symptoms of chronic appendicitis, from which she had suffered for two days. This illness began with pain which was more or less general over the abdomen. Later the pain became limited to the lower half of the abdomen, somewhat more marked, however, on the right side than on the left. There had been no vomiting, and with enemata the bowels had moved freely.

The general condition of the patient, at the time of entrance, suggested little in the way of constitutional disturbance, and her face was not expressive of severe pain. Temperature, 100.5, pulse, 100, no spasm of abdominal muscles, moderate tenderness in lower abdomen, especially on the right side. The diagnosis of chronic appendicitis was made, and at operation—some days later—the appendix was removed. It presented the appearances of chronic inflammation. It was not opened, however, but was sent at once to the pathologist.

Dr F B Mallory kindly furnished the following report on the specimen, and also the photographs (see Figs 1, 2 and 3)

"The gross specimen consists of an appendix 5 cm long. The serous surface is congested. The mucous membrane is grayish and gelatinous. Occluding the lumen 1.5 cm from the distal end is a yellowish nodule 0.6 cm in diameter.

"Microscopically the nodule consists of irregular masses of epithelial cells arranged in an alveolar manner in a moderately abundant connective-tissue stroma. The epithelial cells occur partly in solid clumps, partly

lining gland-like cavities. Some of the larger clumps of cells show several small lumina present. The epithelial cells vary in shape from spiciform to cuboidal and cylindrical.

"The growth is limited to the mucosa and submucosa, of which remains are still evident in places. The muscle coats are not invaded. On the other hand, they show considerable infiltration in places with lymphocytes and a few of the lymphatics in the serous coat are filled with similar cells. These cells indicate a chronic inflammatory process, but whether due to the tumor or to a separate process it is impossible to state positively. The infiltration is identical in appearance, however, with the condition found in many appendices removed between attacks of inflammation.

"Anatomical diagnosis, carcinoma of appendix, chronic appendicitis"

The patient made an uneventful recovery from the operation, and was discharged from the hospital twenty-four days after it.

Since this I have heard from her from time to time, and, finally, last February, in answer to a note of inquiry, I received a letter in which she used the words "I am in the very best of health at present and have been since the time of my operation."

A month later, at my request, the patient presented herself for examination. I made a careful examination of the abdomen, especially of the right lower quadrant, but failed to find any indication whatever of recurrence. The patient was apparently enjoying excellent health. This was nearly $5\frac{1}{2}$ years after operation.

This case is reported (1) because, in view of there being no evidence of recurrence $5\frac{1}{2}$ years after removal of the carcinoma, the growth was probably primary in the appendix, (2) because the appendix was removed on account of appendicitis, there being no suspicion as to malignant disease until the report on the specimen was returned by the pathologist.

Apparently the attack of appendicitis was an important factor in saving the patient's life

FIG 1



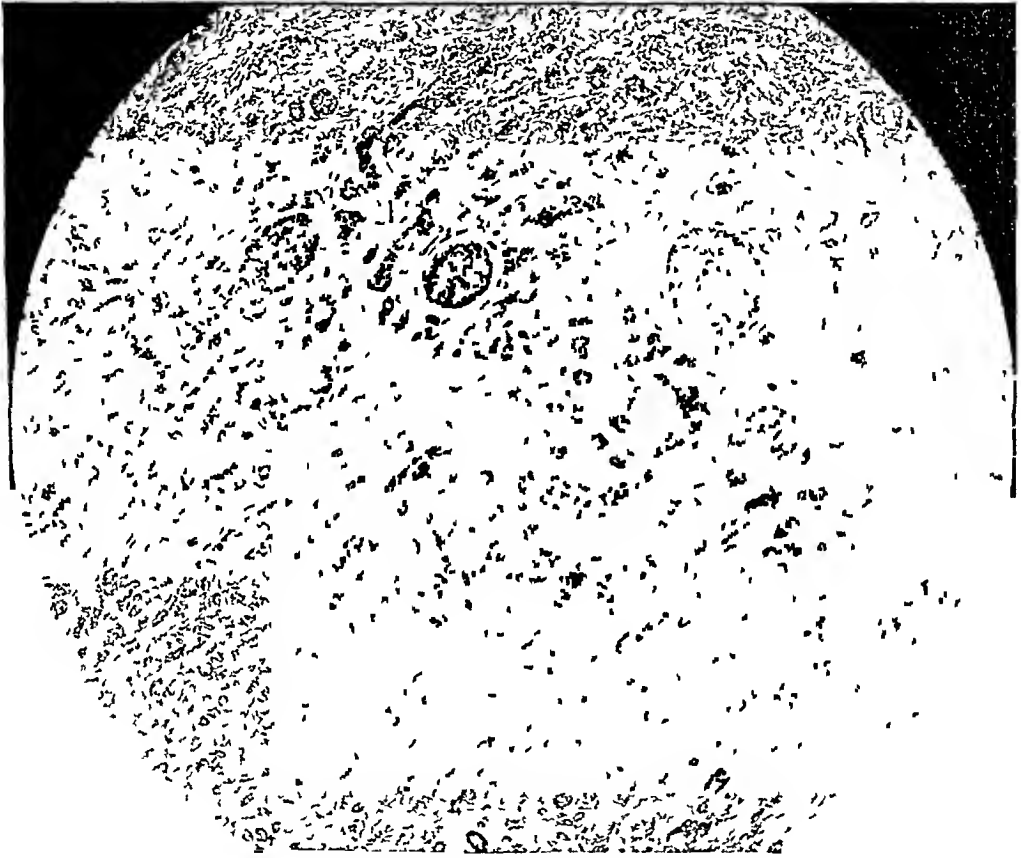
Cross section of appendix which has been slit open longitudinally shows tumor involving mucosa and submucosa

Fig 2



A portion of section displayed in Fig 1 under moderately high power to show the alveolar arrangement of the tumor

FIG 3



Same as in Fig 2 but under higher power

CHYLE CYSTS OF THE MESENTERY.*

BY WILLIAM BARRETT BRINSMADE, M.D.,

OF BROOKLYN, NEW YORK

Surgeon to the Long Island College and St. John's Hospitals

THE first accurate description of this disease is found in the report of an autopsy by Rokitsansky in 1842. Hahn in 1887 made the first classification of mesenteric cysts, which included those containing chyle as a distinct class.

The mesentery of the small intestine consists of two layers of peritoneum, which separate as they approach the intestine to enclose it and form its peritoneal coat. Between the layers of the mesentery we find fat, lymph vessels with blood vessels accompanying them, and mesenteric glands, varying in number from 150 to 200. The lymphatic vessels which are here called lacteals, on account of the color of the fluid they carry, form by two plexuses in the villi of the small intestine. One plexus lies between the muscular coats, and one beneath the mucous membrane. They anastomose freely and are accompanied by a very complete set of blood vessels, as is beautifully shown in the dissections of Mr. Evans³⁹.

The lacteals leave the intestines and extend about 1½ inches to the first series of glands, there they become fewer in number and larger in calibre, and extend to a second series of larger glands situated on the primary arches of the arteries. From these again the efferent vessels of the third set of glands unite to form two or three trunks, or one trunk of large size, the *truncus lymphaticus intestinalis*. This joins with the right and left *truncus lymphaticus lumbalis* to form the *receptaculum chyli* of Pecquet.

These cysts may appear either as dilated lacteals, as collections of chyle between the layers of the mesentery, or as enlargements of the *cysterna chyli*.

* Read before the New York Surgical Society, May 13, 1908

Most observers find the cause of the trouble in a degenerated lymph gland. The theory being that as the gland becomes obstructed, obliteration of the efferent vessels at the site of the gland takes place, and there being an unhindered flow, in the afferent vessels, there must be an accumulation of chyle. Werth³ and Martin have each found a portion of hypertrophic mesenteric gland on pieces of the cyst wall removed for examination. Martin found a gland in condition of cystic degeneration and was thus able to confirm this theory.

Neither endothelium nor epithelium have ever been found on the inside of the cysts.

It will be seen that the size of these cysts will depend on the location of the lesion along the lacteal tract, and on the limit of expansion of the containing walls.

Several lymphatic glands may degenerate about the same time and form a number of cysts, as is illustrated in the annexed table. The cyst may become displaced by its own weight, so as to form a pedicle, or, it may occupy such a position as to partly occlude the bowel by pressure.

Two cases of this disease have come under my observation.

CASE I.—The first patient was a male 32 years old. He had had several attacks of abdominal pain which were referred to the appendix. He had suffered from indigestion and had been careful of his diet for some time. At the time of operation he had been suffering with symptoms of appendicitis for one week. His abdomen was greatly distended. A mass could be felt in the region of the appendix. Strangely enough he did not feel very badly and had walked to Dr. Parrish's office where I saw him. He was sent to the Long Island College Hospital and a gangrenous appendix removed with a quantity of foul pus. The peritoneal coat of the colon was also found gangrenous. After this operation the patient improved somewhat in general condition, but his abdominal distention remained. A fecal fistula formed the third day after operation, but even this did not relieve his distention. His pulse ranged between 120 and 130, and his temperature between 101° and 103°. He vomited occasionally and had distress after taking milk. There had been several un-

satisfactory fecal movements with the expulsion of some gas. Expecting to find a pocket of pus, I explored the wound with my finger and felt a tense mass in the direction of the umbilicus, this ruptured easily and unexpectedly, filling the entire wound with a fluid that looked like thin milk and contained many flakes. I had evidently ruptured a chyle cyst. About 4 ounces of this fluid was sponged out and a drain inserted.

A few hours later the distention of the abdomen was much relieved, and there had been free evacuations, both by the natural passage and through the fistula. For several days there was a local point of tenderness over the region of the ruptured cyst and pressure there would produce chyle in the wound. This tenderness passed away in four days but the flow of chyle, in diminishing quantities, persisted for seven days. In this case we had in all probability a lymph gland degenerated as a result of the peritonitis, with an extravasation from one of the lacteal radicals forming a chyle cyst. This cyst pressed on the intestines which were already glued together by peritonitis and added to the partial obstruction. At any rate the rupture of the cyst almost immediately relieved the symptoms of obstruction. The patient gradually made a complete recovery. Of course the cyst may have existed for some time without giving symptoms. I find no case reported in the literature of a chyle cyst complicating appendicitis.

CASE II.—An Italian eighteen years old was seized with acute abdominal pain March 24, 1907, he suffered from nausea and vomiting, but as it was on a Sunday night after indulging in over-eating, not much attention was paid to him. He recovered and went back to his work after three days. Two days later he had a return of the same symptoms in a more aggravated form. I saw him, through the kindness of Dr. De Yoanna, on the seventh day of his sickness. We then obtained a history of indefinite abdominal distress extending over some months. The patient associated a blow received on the abdomen, with this distress.

When we saw him he was having paroxysms of pain with some nausea. His bowels had been moved only after several enemas, and then in an unsatisfactory manner.

A tumor of the size of a foetal head could be easily made out, lying between the umbilicus and the pubis. It was freely movable in all directions, but traction downward caused pain.

CHYLE CYSTS OF MESENTERY

Number	Reporter	Sex	Age	Location	Operation	Origin	Size	Recovered	Died	Remarks
1	Wechselbaum	M	80		Incision, drainage	Between layers of mesentery	$\frac{3}{4}$ inch diam	x		Probably congenital
2	Winwarter	F	4 mo	Near vertebral column	Incision, drainage		3 liters	x		Large abdomen since birth
3	Werth	F	39	Umbilical region, median line	Extirpation	Mesenteric gland	Child's head	x		Punctured four times
4	Kuester	F	21		Extirpation	Between layers of mesentery	Adult's head	x		Noticed tumor for 3 months
5	Killian	F	61	Umbilical region	Incision, drainage	Distended ductus thoracicus	Large tumor	x		Pain after eating
6	W	M	31		Extirpation	Mesenteric gland	Adult's kidney	x		Septic peritonitis from wounding the bowel
7	Fenominoff	F	26		Extirpation	Mesenteric gland	2 fists	x		Noticed tumor for four weeks
8	Sohlein	F	57	Umbilical region	Incision, drainage	Mesenteric gland	4 fingers broad	x		Tapped twice 4700 cc of chyle withdrawn
9	Rasch	F	21	Median line mostly to left and toward pubis	Incision, drainage	Between layers of mesentery	6 pts	x		$\frac{1}{2}$ liter fluid withdrawn severe pain
10	Bramann	M	63	Umbilical region Freely movable	Incision drainage	Cysterna chyle	Child's head	x		2 tea cups of fluid No pain
11	Carson	M	42	Umbilical region	Incision, drainage		Adult's head	x		Diarrhea and pain for 8 weeks
12	Fetherston	F	33	Pubis to 1 inch above umbilicus Movable	Incision drainage	Mesenteric gland	Adult's head	x		Cause stated to be rupture of chyle vessel
										7-800 grm fluid Pain after eating
										Wall very thick and hard
										Noticed tumor for 18 mos
										Pain severe for 3 mos 3 pts fluid

CHYLE CYSTS OF MESENTERY (Continued)

Number	Reporter	Sex	Age	Location	Operation	Origin	Size	Recovered	Died	Remarks
25	Eve	M	3½	Right lumbar region	Excision of sack Tumor com- pressed intes- tine	Mesentery	32 oz		x	Ac intestinal obstruction for 4 days Died of shock
26	O Conor	M	41	Between umbilicus and pubis	Part of wall re- moved Sac drained	Between layers	Cocoonut	x		Many dilated vessels
27	Bennecke	M	5		Extirpation	Mesentery	1 child's head 1 fist	x	x	2 cysts
28	Dalziel		3		Extirpation	Mesentery	20 oz	x		Tumor had twisted the in- testine
29	Spaeth	F	39	Med line umbilicus and pubis	Incision drainage	Mesentery	2 fists	x	x	Severe pain in abdomen for several months
30	Beach	M	55	Right side to pubis Freely movable	Puncture Incision and drain age	Between mesenteric layers	8 oz	x	x	Tumor noticed 1 or 2 months Pain after eating
31	Anufrejew		26		Incision and drainage	Mesentery	100 c c	x		
32	Ritter	M	2½		Extirpation	Between mesenteric folds	Child's head		x	Abdomen increased in size for 1 year Child has been weak and rickety
33	Smoler	M	60	Above umbilicus	Incision, drainage	Mesenteric gland	Child's head	x		Tumor noticed for 3 months Pain after eating
34	Fawcett	F	3 mo	Partly in cavity of pelvis	None	Mesentery	2½ x 1½ inch		x	Child too ill to be operated
35	Panaas	M	45	Near umbilicus Freely movable	Punctured	Mesentery	1 liter	x		Pain in epigastrium
36	Pean	F	26	Umbilical region		Between layers mesentery	10 liters		x	Amenorrhea for 3 years Died 3d day from peritonitis

	St Thomas ptl Rep	Hos- M	35	Umbilical region, lower abdomen	Evacuated	Between layers of mesentery	30 oz	1	Tumor noticed for 5 mos
37	Speckert	F	29	Med line umbilical region and to right. Freely movable	Extirpation	Mesentery	2½ liters	1	Pain in epigastrium Sick 4 mos Abdomen enlarged Pain at defecation
38	Brinsmade	M	32	To right of umbilicus	Ruptured, accidentally, drainage	Degenerated mesenteric gland probably	Foetal head	1	Ruptured by finger while exploring wound 4 days after operation for gangrenous appendicitis Partial intestinal obstruction immediately relieved
40	Brinsmade	M	18	Umbilical region extending toward pubis	Cyst-wall sutured to abdominal wall Incision, drainage	Mesenteric gland	10 oz	1	Indefinite history of injury Slight abdominal pain, for three months, after eating Acute symptoms for 7 days Omentum adherent to cyst

AUTOPSIES

	Enzmann	F	77		Thoracic duct		Walls thick and flabby of endocarditis	Died
41	Roktansky,	M	53		Mesenteric gland		Several small, one large cyst	
43	Virchow						Multilocular chyle cysts	
44	Roktansky	M	36				Chyle cyst	

There was dulness on percussion over the tumor and resonance all around it. The tumor felt tense and apparently fluctuated. The patient's temperature was 100 and his pulse 120. It was evident that he needed surgical assistance and he was sent to St John's Hospital.

On opening the abdomen over the tumor, we found a large fluctuating cyst with the omentum adherent to its anterior surface for a space of two inches. After freeing this attachment the tumor was easily lifted up into the wound and found to lie between the folds of the mesentery. There were many dilated blood vessels on the surface of the cyst. The tumor had narrowed the calibre of the intestine by flattening it out. After attaching the wall of the cyst to the parietal peritoneum it was incised and drained of about 10 ounces of milky fluid. The inside of the cyst was gently cleaned with gauze sponges and a gauze drain inserted. The wound discharged a very small quantity of chyle during the next three days, then rapidly narrowed down to a sinus. The patient left the hospital on the eleventh day at his own request. He returned to the out-patient department a few times. The sinus gradually closed and he is reported to have been well since that time.

This case is fairly typical of most of the reported cases.

The report on the specimen showed a creamy white or yellowish fluid, alkaline in reaction, with a specific gravity 1018. White corpuscles were present in large numbers. Fat globules were also present in large numbers. There was a large amount of fine granular amorphous material.

I have tabulated forty-four cases, including my own, for reference. There are other cases reported and referred to in the article by Speckert³⁸. Seven of these cases are referred to by Carson¹¹.

From an examination of this table it will be seen that chyle cysts of the mesentery occur at all ages. Three of the forty cases here reported are probably congenital, and the oldest patient was in his eightieth year. The cysts occurred about equally in males and females.

Two deaths occurred in cases not operated, and one death

in a case in which the operative procedure was not noted. One case in which the entire abdomen was implicated, died of shock. Another case died six weeks after operation in convulsions. The remaining thirty-five cases were treated surgically. Incision and drainage were practised in eighteen cases with no deaths. Extirpation was practised in fifteen cases with five deaths, puncture was practised in two cases with no deaths. It will be noticed that several of the histories note increased pain after eating. This is explained by the increased activity of the lymphatic system at that time.

A comparison with the following statistics, published in Tuffier's article, is of interest.

Thèse de Klefstad 1892, eighteen cases of chyle cyst treated surgically. 7 incision, 7 recovered, 10 extirpation, 8 recovered, 2 died, 1 puncture, 1 died.

Thèse de Deffains, 1894. Cysts of the mesentery treated by

1 Puncture 4 sanguineous, 3 recovered, 1 died, 2 serous, 1 recovered, 1 died, 1 hydatid, 1 recovered.

2 Extirpation 7 chyle, 6 recovered, 1 died, 7 serous, 6 recovered, 1 died, 2 sanguineous, 1 recovered, 1 died, 1 hydatid, 1 recovered, 1 dermoid, 1 recovered.

3 Incision 5 serous, 5 recovered, 7 chylous, 7 recovered, 2 hydatid, 1 recovered, 1 died, 1 sanguineous, 1 recovered, 1 dermoid, 1 recovered.

In conclusion we may say that chyle cysts of the mesentery are rare but may occur at any age, and may be of almost any size. In diagnosis they are hardly to be differentiated from other fluid tumors of the abdomen. They are freely movable and are found in the umbilical region. They are not true cysts, and no attempt at extirpation should be made. The safest procedure is to suture the mesenteric wall of the tumor to the parietal peritoneum, then incise, evacuate the chyle and drain.

REFERENCES

- ¹ 1875 Weichselbaum Virchow's Arch, Bd 64, p 145
- ² 1879 Winwarter Med-Chir Centralbl, p 4
- ³ 1882 Werth Archiv f Gynecol, v 19

- ⁴ 1882 Kuester Ein Chirurg Erkentruss, Berlin
- ⁵ 1886 Kilian Berl klin Wochenschr, p 407
- ⁶ 1887 W Milliard & Tilliant in Han's paper Berl klin Wochenschr, No 23
- ⁷ 1888 Fenominoff Lond Med Rec, Aug 20
- ⁸ 1889 Sohlein Berl klin Wochenschr, p 557
- ⁹ 1889 Rasch Obstet Trans, p 311
- ¹⁰ 1889 Bramann Arch f klin Chir Bd 35, p 201
- ¹¹ 1890 Carson J Am Med Assoc, May 10
- ¹² 1890 Fetherston Aust Med Jour, p 475
- ¹³ 1890 Gusserow Charite-Annaler, v 15, p 613
- ¹⁴ 1892 Suffier Bull Soc Chir de Paris, p 582
- ¹⁴ 1892 Tuffier Bull Soc Chir de Paris, p 582
- ¹⁵ 1892 Tuffier Bull Soc Chir de Paris, p 582
- ¹⁶ 1893 Quinson Centralbl f Chir, p 111
- ¹⁷ 1894 Wenning Cincin Lancet Clinic, p 653
- ¹⁸ 1895 Hover Trans Ohio Med Soc, p 363
- ¹⁹ 1895 Reynier Gazette des Hospitau
- ²⁰ 1895 Pagenstecker Berl klin Wochenschr, No 42
- ²¹ 1896 Syms Ann Surg, p 605
- ²² 1897 Moynihan Ann Surg, p 1-30
- ²³ 1897 Moynihan Ann Surg, p 1-30
- ²⁴ 1897 Eve Lancet, p 1246
- ²⁵ 1897 Eve Lancet, p 1247
- ²⁶ 1897 O'Connor Brit Med Jour, p 391
- ²⁷ 1897 Benecke Berl klin Wochenschr, p 659
- ²⁸ 1898 Dalziel Glasgow Med Jour, v 49, p 192
- ²⁹ 1898 Spaeth Muench Med Wochenschr, p 1083
- ³⁰ 1898 Beach Bost Med & Surg Jour, p 489
- ³¹ 1898 Anfrejew Centralbl f Chir, p 920
- ³² 1900-2 Ritter Zeitschr f Heilkunde, 1 Bd 21
- ³³ 1901 Smoler Beitr f klin Chir, Bd 32, p 291
- ³⁴ 1901-2 Fawcett Trans Path Soc, London, v 53, p 406
- ³⁵ 1901-2 Pannas Deutsche Zeitschr f Chir, Bd 33, p 137
- ³⁶ 1901-2 Pean Deutsche Zeitschr f Chir, Bd 33, p 138
- ³⁷ 1904 St Thomas Hosp Rep, v 31, p 184
- ³⁸ 1905 Speckert Archiv f klin Chir, v 75, p 998
- ³⁹ 1907 Evans Am Jour of Anat, Aug, 1907

THE ETIOLOGY OF HYDRONEPHROSIS

BY FAXTON E GARDNER, M.D.,

OF NEW YORK CITY

THE description of hydronephrosis in classical treatises gives hardly that satisfactory impression of unity one feels after reading a well known and coordinated chapter of nosology. It throws together a number of pathological conditions having but few common features. The list of causes is most heterogeneous including, as it does, *malformations*, such as imperforations of the urinary tract, stenoses, kinks and torsions of the ureter, *compressions*, depending on an infinite variety of lesions ranging from embryonic remnants and abnormal arteries to tuberculous glands, with the prolapsed, gravid, fibromatous or cancerous uterus, and newgrowths of the bladder and prostate as most frequent causes, *obstructions*, by calculi, by tumors, *traumas*, *kidney mobility*, etc. And when the tedious enumeration is over, then comes the damaging admission that there are still other cases, the etiology of which is as yet unknown.

All these affections have but one anatomical substratum in common, namely, aseptic distention of the kidney, in all other respects, they differ widely. The pathology is not the same, nor is it even sometimes comparable between cases, for instance, what resemblance between a renal distention due to an imperforation of the urethra and one ascribed to the crossing of the ureter by an anomalous blood-vessel?

The evolution is different the gravity varies greatly and so do also naturally therapeutical indications.

This wholesale linking of all distentions of urinary ducts by an amicrobian liquid, whatever may be the primordial cause of the trouble, has no advantages whatsoever. It has, on the contrary, numerous drawbacks, especially from the therapeutical standpoint. How can we consider fruitfully in a same paragraph such radically different operations as the

removal of a uterine fibroid, the extraction of an impacted stone, and a plastic operation on the pelvis and kidney?

Such a medley is, however, bound to stay as long as text-books give the following simple and elastic definition of hydronephrosis. A distention of the pelvis and kidney by aseptic urine. This definition is incomplete and misleading, because too comprehensive in one way, and too narrow in the other.

It is too comprehensive. Of the two requisites of a good definition it fills only one,—it applies *toto defuncto* but not *solo defuncto*. all hydronephroses are renal aseptic distentions, but not all sterile distentions of the kidney deserve the name of hydronephrosis, or else the chapter on hydronephrosis becomes a mere chapter on general pathology.

It is too narrow, because it would lead us to believe that only those collections containing *urine* may be classified as hydronephroses. The contents of a true hydronephrosis are undoubtedly urine at first, but only for a limited time, in old cases the chemical composition is markedly changed, the liquid may become bloody, flaky, turbid, and the condition still be a genuine hydronephrosis.

For the sake of clearness, it is desirable to split the group of affections hitherto described as hydronephroses and to try to delimit the class of cases to which we might rightfully restrict the name. This is not very easy to do, but when it is done, we find that we have separated a most important group, showing some homogeneity in the etiology, the clinical appearance, and also the treatment.

The specific difference of the cases of aseptic renal distention we want to bring together under the name of hydronephrosis, is that in those cases said renal, or rather renopelvic, distention is a disease *in itself* and not simply an accessory and secondary phenomenon in the course of another disease.

If we apply this principle, first we strike out all those cases in which the distention of the kidney is merely a part of a generalized distention of the urinary tract. For instance, in stenoses of the urethra, renal distention is a relatively

common occurrence, if the obstacle to urinary flow is sufficiently marked. It may occur in acquired strictures, but is more frequent in malformations, valvules of the urethra or septal duplicity of the bladder. Then the obstructive agent acts through vesical retention, the distention is bilateral and progresses gradually upwards and finally reaches the kidney. Is it logical to call hydronephroses and consider as a special disease this last stage, this ultimate result, of vesico-uretero-pelvis distention?

Let us also put aside all cases in which the urinary distention, though localized to the upper urinary tract, perhaps even to one ureter and one kidney, is only an epiphenomenon, a complication, in the evolution of an altogether different disease. In this class of facts, we place many of the compressions, such as those exerted by pelvic or gynæcological tumors. In many cases, as in carcinoma of the uterus, of the prostate, the vagina, the rectum, renal distention is only accessory, overshadowed as it is by the extreme gravity of the primary affection. In other instances, as in fibroids, procidentia uteri, ovarian cysts, or in those rare cases of renal distention caused by peritoneal exudates or tuberculous glands, the mutual relations of the cause and the resulting hydronephrosis are not exactly the same, the condition of the kidney may acquire a very high prognostic significance, and change an operation for the relief of the above-mentioned lesions from a harmless procedure into a very hazardous enterprise.

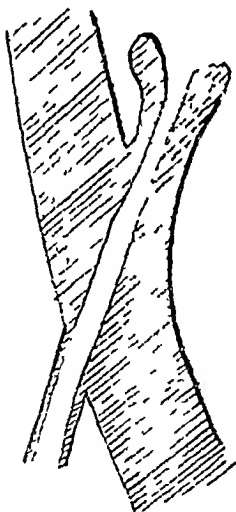
When we have thus cleared the field of a tremendous amount of material, exceedingly interesting indeed from many standpoints, but which must be sorted out under several other pathological headings, where it rightfully belongs, what is left? A class of cases in which the renopelvic distention is the chief feature of the disease, the dominating and essential element. *Anatomically*, the distention is limited to the pelvis and calyces, though sometimes it affects the ureter also, but the dilatation of the latter canal remains accessory. *Etiologically*, all those cases result from non-malignant alterations of the ureter, more particularly defects of its upper segment.

Symptomatically, they are all characterized by a tumor, in the clinical sense of the word, said tumor varying considerably in size. *From the standpoint of prognosis*, they are all benign, *therapeutically* and, last, they all require an intervention on the urinary tract. Consequently, we find between those cases enough similarity to feel justified in uniting them in one group. To that group we restrict the name hydronephrosis.

The narrowing of the scope of hydronephrosis will naturally cause a parallel shortening of the etiological list.

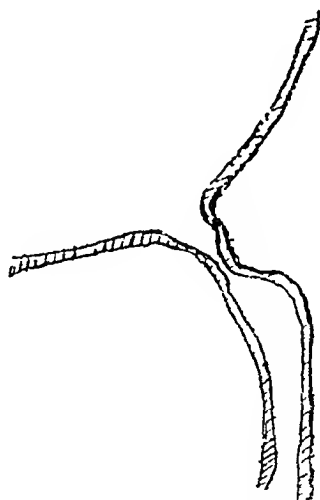
Of the two classes established by a time-honored division, viz., congenital and acquired, the latter class is much the heavier loser, it loses all pelvic benign tumors, all malignant new-growths and a few rarer causes of compression, while the congenital class loses only the hydronephroses due to an imperfection of the lower urinary tract, which are comparatively unfrequent.

FIG 1



Congenital malformation (Gerster)

FIG 2



Congenital stricture (Moynihan)

But, aside of this limitation, the class of acquired hydronephroses is doomed to lose many more cases which will change sides and array themselves in the rival class. For instance, many of the hydronephroses, formerly attributed to kidney mobility, are now justly ascribed to congenital defects.

of the upper part of the ureter. Again, hydronephroses caused by vascular anomalies of the kidney must be switched to the congenital group, though their lot has been heretofore cast with the other.

Thus, the class of congenital hydronephroses which, fifteen years ago, was still deemed the lesser and was supposed to contain only pathological curiosities, towers to-day above the other, and each dismemberment of the latter enriches it.

It is not intended to give here an exhaustive study of all possible causes of hydronephrosis. We propose to dwell longer on some of the disputed points, insofar as it can throw some light on that all-important and final aspect of all medical problems, namely, treatment.

CONGENITAL HYDRONEPHROSES

All these are caused by a congenital imperfection of the ureter. Such an imperfection is an abnormality. Therefore, the best start in a study of the question is a review of the development of the ureter. We shall expose here whatever is needed for a good comprehension of our subject.

The ureter springs as a dorsal evagination of the caudal end of the Wolffian duct. Said evagination ascends in the mesoderm and, while ascending, ramifies. Its offshoots form the pelvis and part of the kidney. Whether they form the whole of the latter, or, what is most likely, only the excretory part, the secretory elements being derived from another origin, is immaterial here, but a movement the ureter executes or seems to execute, around the Wolffian duct, is very interesting. The ureter is first on the dorsal side of the duct, it successively becomes dorsal and external and finally ventral. The amplitude of the rotation is about 180° . Kuppfer denies that there is any real rotation, because, while the ureter seems to revolve around the Wolffian duct, the distance between the two is constantly increasing. But we must note that in this movement the vesical end stays fixed and that the upper extremity alone moves and therefore the duct cannot but become twisted around its axis. This rotation must be borne

in mind because its rôle in the production of some hydro-nephroses is certain, though variously estimated

Much more important and less hypothetical are the facts we are going to consider now. At the end of the third month of intra-uterine life, the excretory organs have assumed their final shape, the primary and intermediate kidneys, pro- and mesonephros, and their excretory canal, the Wolffian duct, have vanished and henceforth urinary secretion, due allowance being made as to the quantity, is comparable to adult secretion. But the ureter is not then the smooth and rather uniform canal dissection shows in full-grown subjects. Its outline is exceedingly uneven. constricted segments follow dilated ones, and valves formed either by the mucosa alone or by a folding-in of the whole wall of the canal, abound. These irregularities are not equally distributed in all points: their most common location is near the renal pelvis, next comes the segment near the bladder and, last, the middle portion, in one word, their elective sites are both terminal parts of the ureter.

Wolffler was the first to draw the attention to these points. In 100 newborns, he found 20 times more or less marked permanent transversal folds of the mucosa. In all of the 20 cases there were some valves near the pelvic ureteral outlet, in a few cases some were found besides at a distance varying from a few millimetres to 1.5 centimetres from the vesical meatus. In ten instances, the jutting parts were prominent annular valves, scarcely letting a filiform catheter pass through the duct. Said valves, according to Wolffler, were formed simply by the mucosa.

But Wolffler's researches had not begun early enough. If, instead of studying newborns, he had examined foetuses he would have been brought to look upon those valves, not as frequent anomalies occurring once in every five cases, but as constant temporary formations in the development of all ureters. This was ably brought to light by English. If we examine a lengthwise section of the whole duct, we notice the

following peculiarities the pyelo-ureteral junction is always a narrow point, the immediately underjacent segment shows always a number of plicatures formed by a folding-in of the whole muscularis. The mucosa covers both sides of the valvule, but the external coat takes no part in its constitution, at the implantation point, the latter bridges over the gap between the two layers of muscularis constituting the valvule and the space thus delimited is filled up with connective tissue.

The number and size of those formations vary, sometimes single, sometimes multiple and placed in tiers one above the other along a short segment of the canal, sometimes low transversal ridges, sometimes real movable valvules, the free edge of which is tossed up and down by the urinary flow. Their implantation on the walls of the ureter is on a somewhat spiral line, hence the serpentine aspect of the canal. At the base of the fold, a little furrow may be seen on the outer coat and, here also, the superposition of these furrows makes the ureter appear as though it were spirally twisted around its axis. The valvules greatly reduce the lumen of the duct, sometimes to such an extent as to prevent catheterization with a hair. Pulling on both ends of the ureter causes the folds to flatten for the time being, but, as soon as the traction ceases, they reform, provided the outer coat has not been torn by too rough a pulling.

Besides these mucomuscular valvules, purely mucous formations are also found, particularly in the juxtapelvic segment of the ureter, some of these are vertical and radiate up into the pelvis where they array themselves in star-like figures. On a few of these mucous valvules without muscularis, papillary raisings have been found.

These three kinds of formations are *normal*,—we desire to lay stress upon the fact. They are always observed in the same part of the ureter, the rest showing none. They exist on both sides and are even almost always homologous; if, however, there is only a narrowing of the lumen on one side, valvules are found on the other. The plicatures take in both the muscularis and the mucosa, but not the outer coat, which

fact precludes the idea of acquired lesions, for in the latter eventuality, all three coats would be involved

At the end of the third month of intra-uterine life, the ureters are thin cords tapering from the lower to the upper end with two markedly distinct segments, the lower is wider and grows faster than the upper which has no distinct lumen, filled up, as it is, by vertical mucous folds, and mucous, and chiefly mucomuscular, valves

All those projections disappear under the action of two factors the eccentric pressure of the urine and the normal growth of the canal When, during the fourth month of foetal life, urine begins to flow through the ureter, the plicatures flatten, the narrow points widen, and the calibre becomes even And at the same time, the length of the ureter increases markedly The lower segment growing quicker than the upper, valves persist where both sections meet, said meeting point corresponding to the pelvic ureteral outlet in the adult Thus is the most frequent location of anomalies in the juxta-pelvic segment accounted for

We easily conceive that, if normal ureteral growth is impeded by any cause, valves will persist The growth of the ureter being influenced by the same factors as the growth of the kidney, we readily understand why abnormalities of the kidney and of the renal blood-vessels are so frequently associated with imperfections of the ureter An arrest of development of any part of the reno-ureteral system cannot but have its "*contre coup*" on the other parts

Thus we account for the frequency of hydronephrosis in ectopic, movable, single, and horseshoe kidneys This explanation is much more logical than the change of direction of the ureter generally given as the reason of retention in horseshoe kidneys As for movable kidneys, the question is more complex and will receive due attention later, many movable kidneys are congenital, but some are not

The two above-mentioned influences work still after birth and tend to perfect the shaping of the ureter almost up to adult life Newborn infants and young children still present

a variety of slight ureteral defects, while in full-grown subjects all pelves show a fairly uniform type

After this summary of the development of the ureter, how can we but think that in the persistency of one of those foetal dispositions lies the cause of most congenital hydronephroses? The constancy during intra-uterine life, the frequency at birth, are weighty arguments and there is ample evidence to prove that the so-called normal strictures of the ureter are traces of those transitory folds

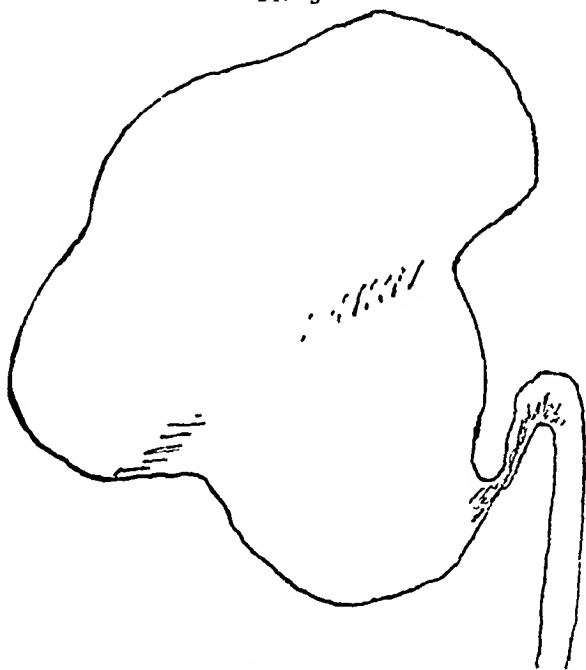
Let us now enumerate briefly the different classical causes of congenital hydronephrosis. It is wrong to make *absence* and *multiplicity* of the ureter head the list, for neither can be a cause of hydronephrosis. We have already stated that no hydronephrosis is possible when the ureter is absent. The two or three cases on record of hydronephrosis supposedly belonging to that type are old cases and are probably based on an erroneous interpretation of facts

Nor can *multiplicity* be a cause of retention. I do not know of any more fascinating study for those who love to delve into embryological puzzles, than that of the development of supernumerary ureters, but it would lead us too far from our path and it is only indirectly connected with our chief subject. Enough is it to say that the anomalous ureter represents, most likely, in women, the Wolffian duct, in men, the Mullerian duct. This accounts for the common termination of said ureter in the utriculus prostaticus in men, in the upper vault of the vagina in women. It may be easily understood that such an important anomaly is frequently accompanied by defects in the calibre, particularly by atresia of the lower opening. Then hydronephrosis develops, but when the diameter is normal, a supernumerary ureter cannot cause any retention. It may give rise to a special variety of incontinence, but in a majority of cases, it does not give rise to any symptoms whatever, and many a man has lived a long life without his anomaly being even suspected. In all but one of the published cases of partial hydronephrosis due to a stenosed super-

numerary ureters, the latter drained the upper part of the kidney, which upper part alone was distended (Rémy, etc), Hochenegg's case is the one exception

The preceding remarks apply integrally to *abnormal endings* of the ureter, the next cause we find on the classical list. Not the abnormal ending provokes hydronephrosis, but the frequently concomitant atresia, or the modifications the anomaly brings in the direction of the ureter flattening of the duct, sharp bends, etc. In Walter's case, the ureter opened too high into the bladder and consequently its

FIG 3



Pseudo stric ure by kink and adhesions

intraparietal course was too obliquely ascending. In a case of Weigert's the opening on top of the verumontanum was very narrow and the corresponding kidney was a large uronephrosis. Needless it is to multiply examples, they are all alike ¹

Kinks and *torison* of the ureter are also causes of retro-distention of the kidney. Thomson, Roberts and Arnould

¹ Special mention must be made of *intravesical prolapse* of the lower end of the ureter, which is not exceptional, and is sometimes associated with hydronephrosis of the corresponding kidney

explain kinks by the embryonal rotation of the ureter around the Wolffian duct. This explanation has generally been held as valid without discussion, but, when carefully scrutinized, it does not seem as illuminating as at first sight. Kinks are much more naturally explained by the persistency of the normal foetal condition. What we have said above dispenses us from dwelling more on the point. But the rotation theory explains very well the torsions that are sometimes observed. We mean here *real* torsion, not the torsion so many authors have considered as a cause of hydronephrosis, but which is only an apparent, a *pseudo*-torsion. Real torsion is rare, we could find but four cases in the literature: the last one was published two years ago by Dr Grégoire, who showed us the specimen. The ureter was plainly twisted around its axis, and the pressure of the liquid within the sac was at times sufficient to untwist it, hence intermittent evacuations. But specimens of that type are rather unique. What is commonly described as a torsion of the ureter is only a peculiar aspect due to the spiroid furrows that mark the implantation of valvules on the ureteral wall, where the outer coat bridges over the tucked-in muscularis. The same thing is well known in the cystic duct where Heister's valvules give a deceptive spiroid appearance while there is no real torsion. And furthermore we do not see very well how the ureter, attached to the kidney above, to the bladder below, can become twisted around its vertical axis. Torsion would be possible only if the kidney revolved also around its vertical axis. Hamonic has admitted the existence of such a displacement, but without quoting any definite examples, and he grants it is only slight, it must be so, because the renal pedicle would soon oppose it. In a case where no renal pedicle existed, Schede saw a real complete torsion (360°).

Anomalies in the calibre are much less frequently mentioned in clinical reports, and, nevertheless, they certainly constitute by far the most important group of causes of hydronephrosis. That this is due to the greater difficulty to detect them is evident, and that we see only what we have learnt

to see is a thread bare truth. They will be found in a very large number of cases, and have already been found whenever they were carefully looked for. *Valvules* are the most frequent, as might be naturally inferred from the development of the ureter. But there may be also plain *strictures* without valvules. We have drawn in Fig 2 such a case, borrowed from Moynihan, the ureter was narrowed as if it had been tied with a tape. Fig 1 represents a peculiar deformity seen by Dr Gerster. Matthews Duncan and Carpenter have published similar cases. This stricture near the pelvi-ureteral junction seems simply an exaggeration of a normal anatomical condition. Bazy on his mouldings found it very often, and Byron Robinson, Poirier and others, have shown that that point is always, even in normal ureters, one of the tight passages.

Embryonal remnants of the Wolffian duct (Launay) or of the Mullerian duct (Reliquet and Mathias-Duval) are rare and deserve no more than a passing notice.

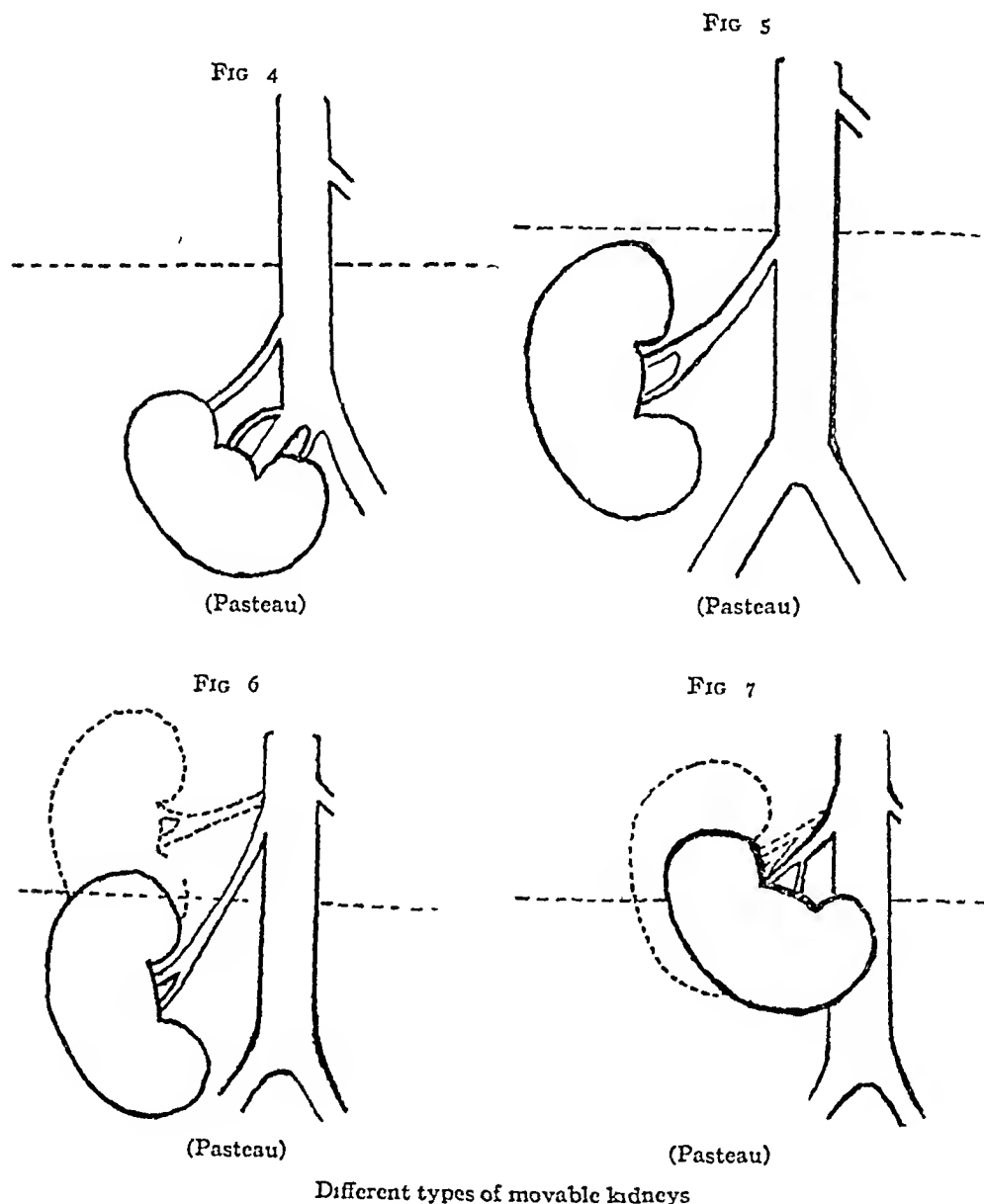
To the group of congenital retentions must be added unhesitatingly many of the cases formerly ascribed to kidney mobility, and hitherto classed among acquired hydronephroses.

Kidney mobility is in most cases congenital. Figs 4 to 7 show the four types of movable kidneys to which all others may be reduced. In the first type, the kidney is plainly ectopic, its blood-vessels are abnormal and have an abnormal origin. In the second, the movable kidney, disposed either vertically or obliquely, may sometimes be pushed upwards up to the lumbar fossa, but the origin of its vessels is still abnormal. In the third type, the kidney is vertical, the pedicle is much elongated and the vessels spring normally from the vascular trunks, while in the fourth the pedicle is short and the kidney oblique.

The two first types are unmistakably congenital, the third is also, while the fourth represents the typical acquired movable kidney. Consequently, if hydronephrosis develops on

account of kidney mobility in a kidney of any of the three first classes, it is a congenital hydronephrosis

But this is not the only reason pleading for the change we are now considering There is another, more important,



namely, that many of the retentions ascribed to kidney mobility *are altogether irrelevant of the latter* and are indeed due to some of those congenital defects the capital rôle of which we have already seen

Such a view, very few years ago would have been revolu-

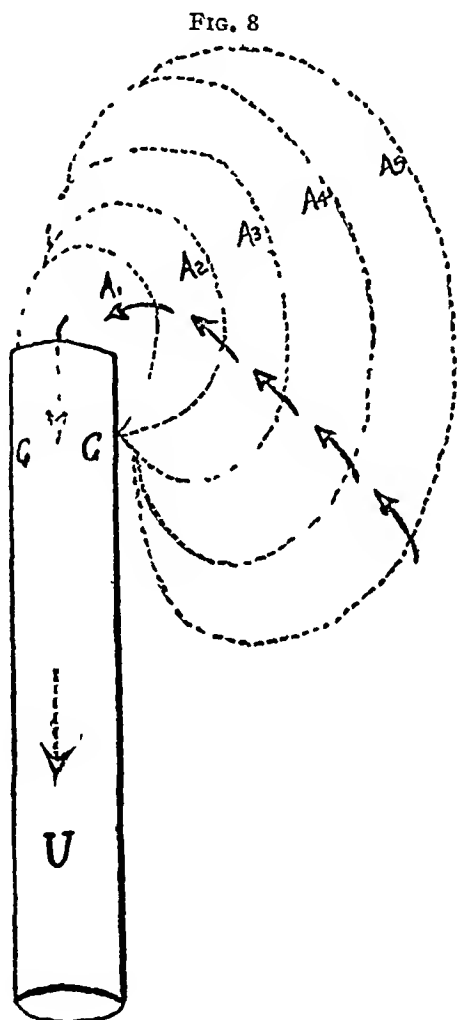
tionary, but it is now fast gaining recognition. Since Landau's series of papers and since Terrier and Baudouin's work, it has been almost universally taken for granted, and believed almost as a tenet, that movable kidneys cause the type of hydronephrosis called intermittent.

The latter is characterized essentially by crises of pain, accompanied by a progressively developing renal tumor, and by temporary oliguria, it ends by a more or less abundant evacuation of urine, while the tumor subsides. A very simple explanation is obvious. When the kidney falls, the ureter kinks, the flow of urine is mechanically stopped, the urine is retained in the kidney, hence the tumor and the oliguria, then later, the obstruction is removed, the accumulated urine is voided, hence the polyuria and the disappearance of the tumor.

Unfortunately for medical truth, this explanation is too simple, too elegant, too logical and therefore too alluring. It seemingly accounts perfectly for everything and makes further investigation seem superfluous. Here we have intermittent symptoms and an intermittent cause, the chronology of which seems to tally nicely together. How could one not be the cause of the other? And if difficulties arise when it comes to deciding as to the mechanism, many ingenious hypotheses can be brought forward and we can even describe more or less imaginary anatomical peculiarities to give our hypotheses a solid substratum. All this has been done in good faith, but nevertheless it is forcing facts into the frame of a theory, instead of enlarging the frame to make it fit the facts, or even casting it off, if the latter adaptation is not possible. The parallelism between renal displacements and intermittent hydronephrosis cannot stand a close scrutiny.

First of all, there is no special type of disease to which the name intermittent hydronephrosis properly belongs. Intermittence is not a characteristic of a *special* kind of retention, it is a common feature of all retentions, and is presented by all at some period of their development. *Hydronephrosis is not simply a distention of the kidney*, if it were, it might be truly intermittent, but hydronephrosis is more than that, it

is a distention with *progressive sclerosis* of the pelvic walls and of the kidney. Now the latter lesions are permanent. Consequently, what is intermittent is not the hydronephrosis, but only the filling and emptying of the sac. Now this has but a secondary importance and is not sufficient ground to establish a distinct type.



(Fenger)

Again, the polyuria which comes after the attack of pain is very often out of proportion with the size of the tumor. In some cases, the excess of urine voided over the normal amount reaches almost a gallon, while the tumor is comparatively small and certainly cannot contain such a quantity of liquid. Inversely, catheterization during the crisis has found sometimes not more than *one ounce* in the pelvis. This shows

conclusively that the supposed relationship between the filling and emptying of the sac and the growth and subsiding of the tumor, are only apparent. The polyuria is not due to the sudden evacuation of a renal retention. The increase in the size of the kidney is due in many cases to an intense congestion of the organ, when the congestion ceases, polyuria sets in, and the volume of the gland falls again to normal. The postcongestive hyperactivity of all organs is a well-known fact.

Beyond any doubt, many of the hydronephroses associated with kidney mobility are congenital, and are due to one of those defects we have already mentioned several times. We should prefer to believe that kidney mobility and hydronephrosis are completely independent from one another. Both are congenital defects; they are simply co-existent. Hydronephrosis does not create mobility, any more than mobility creates hydronephrosis. We simply have to deal with an hydronephrosis *in* a movable kidney.

But is there no room left for hydronephrosis caused *by* kidney mobility? Extremists say no, but we think there is on the question a vast amount of clinical and experimental material which we have no right to disregard. No doubt it would be more satisfactory to the mind, always intent on uniformity, if it were proved that all hydronephroses associated with kidney mobility are in fact congenital hydronephroses, but this we do not believe to be rigidly exact. Certainly, retentions due to kidney mobility must be reduced enormously in number, but they must not be wiped out entirely. The point will be dwelt on later.

An argumentation much along the same lines applies to those cases of hydronephrosis commonly ascribed to pressure of an abnormal blood-vessel on the ureter. If such a pressure begets hydronephroses, the latter must be termed congenital, although, in text-books, they are generally classified among acquired.

In some cases of hydronephrosis, the ureter has been

found, near its origin, astride on an anomalous blood-vessel, an artery in most cases, a vein in a few exceptional instances. This is enough to have the question of causality raised.

The solution is not evident at first sight, the vessel may be the cause of the retention, but it may also have nothing to do with it, and simply have assumed connections with the sac secondarily as a consequence of the growth of the latter. In the literature cases may be found demonstrating both eventualities.

In all cases, the blood-vessel is *abnormal*. Anatomy tells us about several arteries which may come into contact with the first segment of the ureter. First, the lowest branch of the renal artery which goes to the lower pole of the kidney may separate prematurely and pass in front of the origin of the duct. Next, supernumerary arteries branching off directly from the aorta, in one out of every four cases, the vessel passes behind the ureter, in the three others it passes in front. Thus, in a vast majority of cases, the anomalous artery crosses the ureter *anteriorly*.

Can such an artery cause hydronephrosis? The older writers admitted it unreservedly, three mechanisms have been put forward: (*a*) intermittent compression by the arterial systolic impulse, (*b*) continuous compression as if by a fibrous tract, and secondary alterations of the canal, and (*c*) more particularly, kinking of the ureter on the vascular cord, determining either a sharp bend or a more or less open curve. Boogard, who observed the first case in 1857, thought even there might be in those cases a *true* intermittent hydronephrosis, the liquid accumulating till its pressure becomes high enough to overcome the arterial obstacle, and then emptying.

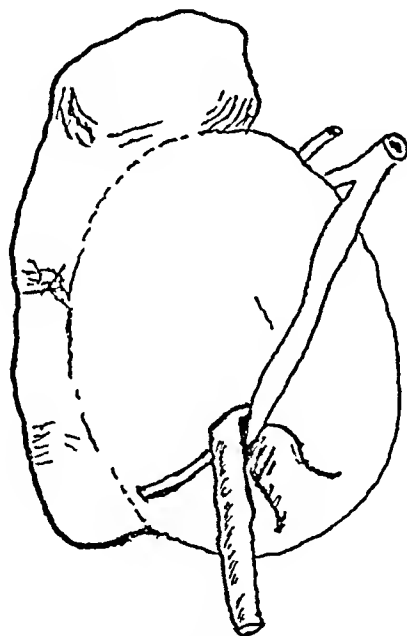
But this is not a matter of course, though apparently simple, and it is bitterly contested now.

English was the first to state that an abnormal artery passing *in front* of the ureter cannot possibly be the cause of a hydronephrosis, because it can never hook the ureter of a movable kidney. If the artery passes *behind* the duct, then

it may hook it when the kidney falls. This conception would reduce greatly the number of cases.

Kuster, Israel, Bazy, Duval and Grégoire, concur. They even reject altogether the rôle of abnormal vessels in the production of renal retentions. As in several cases the presence of a ureteral malformation is expressly noted (Roberts, Morris, Decressac), they contend that *all* hydronephroses developed in kidneys showing an abnormal blood-distribution

FIG 9



(Decressac)

are due to such defects. They assert that *because* of the uro-nephrosis does the vessel come into contact with the ureter. Of course such a theory is tenable, kidney mobility, abnormal vessels and ureteral defects belong all three to the same class of errors of development and, when one exists, the chances are that some of the others exist also. But it is partly hypothetical and we think it is carrying the desire for uniformity too far.

From Bazy's own drawings, purporting to prove that a pre-ureteral vessel could not produce a retention, while a retro-ureteral vessel could, Pierre Delbet drew diagonally opposed

conclusions. And a peculiarity noted several times sustains the idea of hydronephroses *by* and not simply *with* abnormal vessels. Figs 9 to 12 represent cases of this type. It may be easily seen that in 9 the dilatation of the ureter does not begin exactly where the artery passes over the duct. In some cases, the dilatation begins above the crossing point, in some cases it extends below. It is plain the artery is not then the cause of the retention. But, in some others, the crossing point marks exactly the beginning of the sac as in Figs 10, 11, 12. Some authors account for this by saying that the crossing point is precisely the part of the ureter where congenital imperfections are most often met with, but is not this straining a point too far? When they assert that, in those cases, before proclaiming the primordial rôle of the artery, we must prove that there is not in the ureter a malformation, they forget that the burden of proof rests upon them and that *they* have to establish the rights of their claim. We, therefore, admit with the older authors, and with Legueu, Hartmann, Luys, Picqué and Carlier, the existence of hydronephrosis *by* vascular anomaly. Those cases are not very numerous, but they exist, and they raise a very interesting therapeutical problem.

ACQUIRED HYDRONEPHROSES

This group as described by classics is the larger, but also the more heterogeneous, of the two. Our definition of hydronephrosis splits it and, with compression cases, takes away more than half of its clinical field. Furthermore, it has been steadily decreasing with the inroads of congenital lesions in its domain, it is now very much reduced, but it is not as near evanescence as some would have us think. It still takes in a very respectable number of cases dependent on the following factors: acquired movable kidney, cicatricial lesions of the ureter, impacted stones, and more rarely inflammatory changes of the duct, ureteritis and peri-ureteritis.

This list is not long when compared to the older ones, but it is sufficient to give acquired hydronephrosis an honorable place in nosology.

Acquired movable kidney is a cause of hydronephrosis, though we have already seen that it is by no means as frequent a cause as has been contended at a time

Experimentally, Tuffier succeeded five times out of nine in producing hydronephrosis by making the kidney movable. But there is one requisite well demonstrated by Legueu, Hildebrandt and Haga that the upper ureter *be fixed*. If it is not, no hydronephrosis can be obtained. Paul Delbet was so impressed by the latter fact as to view ureteropyelitis as the only real cause of hydronephrosis, but his, like all extreme theories, contains some truth, but overshoots the mark, and gives too much weight to a single etiologic factor.

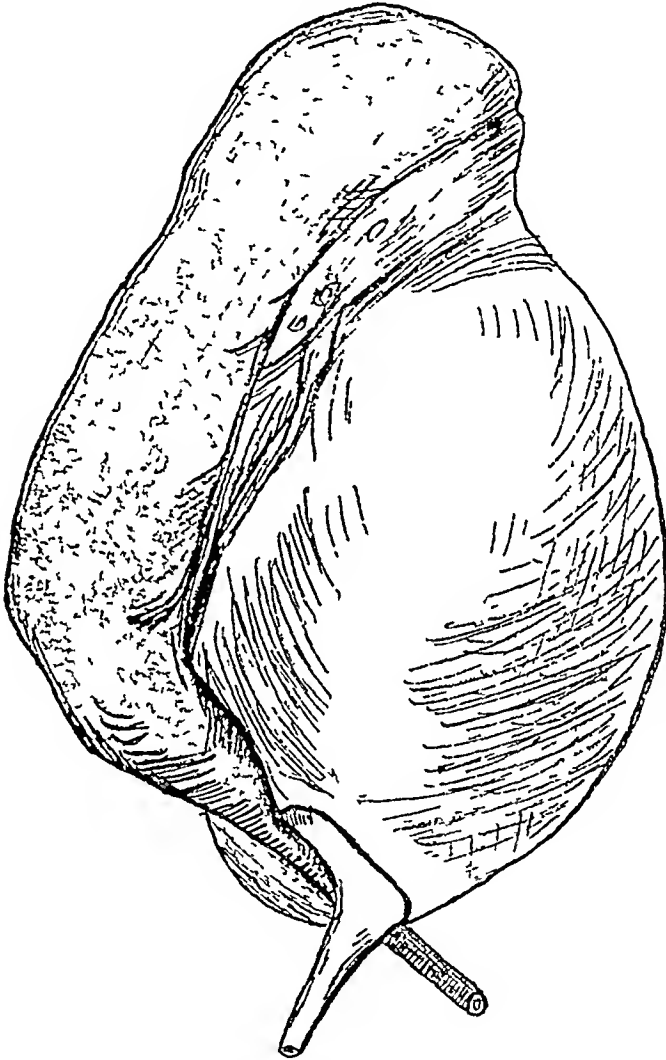
If kidney mobility may under some circumstances provoke hydronephrosis in animals, why should it not do it in man? All agree that a slight obstacle to urinary flow is enough to cause a retention. Why deny the same right to kinks of the ureter, constant in cases of movable kidney? Ureteral catheterization shows the presence in the pelvis of simple movable kidneys of small retentions varying from two drachms to an ounce or more. May we not rightfully consider these as the starting point of larger accumulations? Those who want to find at any cost a congenital malformation at the origin of every hydronephrosis do not let such minor facts nettle them. They say those small retentions are not hydronephroses, because they lack an essential element,—namely, sclerosis of the walls of the sac. But do not even congenital hydronephroses go at first through an initial stage when sclerosis of the walls has not yet begun? A retention does not, from the outset, contain a pint of liquid, it must begin by a few drachms or an ounce.

Willing, as we are, to grant that many hydronephroses hitherto ascribed to kidney mobility, are really due to congenital defects, that movable kidney is itself, in a great majority of cases, a congenital disease, we still stoutly defend the existence of acquired hydronephroses, caused solely by the mobility of an acquired movable kidney.

Wounds of the ureter are not common, but the resulting scars are so constituted that the risk of retrodistention is

great Judging from the nature of the healing process, stenosis seems an unavoidable contingency and experimental and clinical surgery of the ureter gives corroborative evidence In the scar, the anatomical elements are atrophied and lost in a dense connective tissue which forms almost the whole of

FIG 10



(Luys)

the ureteral wall and even, in some cases, extends considerably beyond, and gives rise to diffuse sclerous peri-ureteritis, thus greatly aggravating the stricture

A wound of the ureter may be produced from within by a stone, we shall have to discuss later calculous hydronephrosis It may also be produced by a cutting or pointed instru-

ment, but, in the latter case, hydronephrosis is an exceptional occurrence. A urinary fistula is a much more common sequel, among hydronephroses, we found but one case, Soller's, concerning a man who was struck in the lumbar region in 1870, during the Franco-German war, by a splinter of a shell, and at whose necropsy, ten years later, a stricture of the left ureter with a large hydronephrosis was found.

Most cases of acquired strictures of the ureter are observed after *deep contusions of the loins*. This brings us to discuss the question of *traumatic hydronephrosis*, a very moot question which, however, seems to be nearing a definite solution.

Most of the cases described as traumatic hydronephroses may be summarized thus: an individual, a man or a child in most instances, falls from a height, the lumbar region striking against a hard prominence, or gets run over by a vehicle, a wheel of which passes diagonally in the costo-iliac space. Right after the accident, the usual symptoms of renal contusion are present: more or less severe pain, shock, hæmaturia. A few days or a few weeks later a large tumor is felt, extending horizontally from the side to the median line, vertically from the hypochondrium to the iliac fossa. Said tumor is *not* heralded in, we insist on the fact, *by either pain or a change in the general condition* of the patient. When tapped it yields a considerable amount of a yellow, transparent, urine-like liquid. After the tapping, the tumor forms anew and it becomes necessary to thrust the needle again, three, four, or more times before a cure is effected.

Such is the history of the princeps case reported by Hawkins in 1834, such are the more recent reports of Stanley, Hicks, Vincent, Croft, Cabot, Nové, Josserant, Froelich and others.

On such a foundation, some writers build a clinical type denominated traumatic hydronephrosis and establish a theory to explain how it is brought about. They take it for granted that the accumulated fluid is really *within* the renal cavities.

The obstacle to urinary excretion is peri-ureteral hæmatoma pressing on the duct. The above-jacent portion of the

ureter dilates and kinks and thus the obstruction becomes complete

But, supposing this theory had an anatomical confirmation, which it has not, we would still wonder how such a rapid and large dilatation of the pelvis and kidney could be possible. Here we have a most unusual feature, never has such a distention as is noted in the clinical reports, been produced in so short a time. Clinically, it takes years before a large hydronephrosis is constituted, experimentally, renal distention follows ligation of the ureter, but never do experimental tumors attain such a huge size. Many searchers have ligated the ureter, I have done it myself several times in the course of experimental work directed along other lines, but I have never seen anything approaching the dimensions of the so-called traumatic hydronephroses.

Another fact deserves attention. These enormous distentions of the pelvis, if such they be, develop without pain. Oftentimes they are detected only because surgeons, after a renal contusion, are wont to palpate the injured region. Now, let us catheterize a ureter and inject some liquid in the pelvis and distend it, ever so little, before five seconds, the patient will be howling and writhing. I have seen it many times. Simitzine and Albarran have demonstrated the fact long ago. Rapid distention of the pelvis is extremely painful, and some would have us believe that enormous hydronephroses can develop painlessly in a few days! And also that those enormous hydronephroses may be cured by simple tapping!

Therefore we find so far in the theory of traumatic hydronephrosis a mere hypothesis lacking anatomical support and presenting several weak points in opposition with well established facts observed time and time again.

Now, what do direct anatomical findings teach us? Hawkins, whose christening of his first case as hydronephrosis was responsible for the birth of the above-exposed doctrine, states himself expressly that, in his case, the volume of the kidney was *normal*, that the flexuous and elongated ureter inserted *normally* on the pelvis and had no connections whatever with the cyst containing the fluid, said cyst being *sub-*

peritoneal and *pararenal*, but altogether *independent* from the kidney Is this a hydronephrosis? It might have been considered as such in 1834 when the terminology was lax, but nobody would keep the name to-day, not even with subcapsular as a corrective The same independence of the kidney and ureter from the collection is noted in all cases of traumatic hydronephroses which came to operation or necropsy This, coupled with some other findings, and the nature of the fluid, will give us the key of the problem

The finding just alluded to is the frequent injury of the pelvis and ureter Two tears existed in the pelvis in Hawkins' case, one in Vincent's Barker found a hole in the ureter and Chaput saw the latter completely torn off The kidney itself is, as a rule, uninjured, and this accounts for the infrequency of hæmaturia much better than the weak reasons given by the partisans of the clot theory

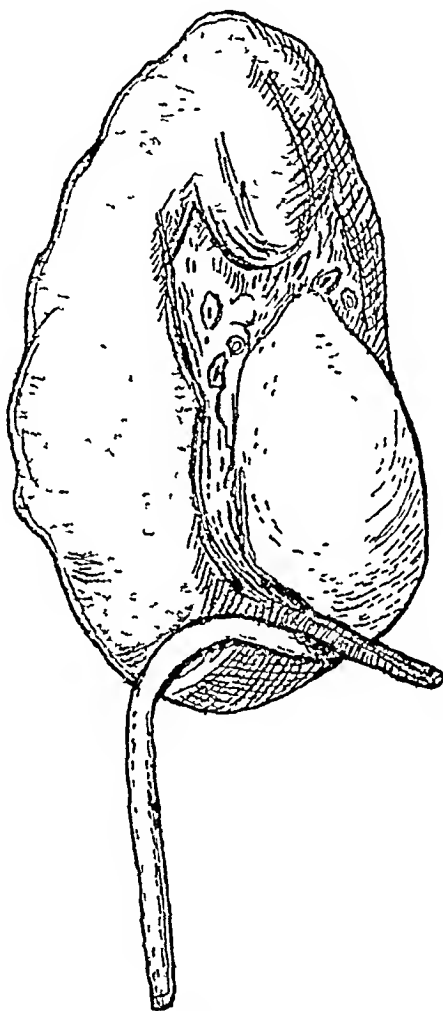
The liquid withdrawn by tapping is *urine*, of course, not exactly normal urine, but nevertheless easily recognizable as such

Let us now simply enumerate the three above-mentioned characteristics and we shall reach the true definition of these post-traumatic tumors an *extrarenal* collection of *urine*, produced by an *injury of the pelvis or ureter* Now we grasp at once the why of the painlessness and of the quick growth of these tumors Here we have a normal kidney, secreting normally, and pouring its secretion into loose connective tissue in which a pouch may be readily excavated While studying the effects of puncture on the pelvis and ureter, we had many occasions to see how painlessly the largest collections develop without any effect on the general condition

That the acute, almost sudden, development of a genuine hydronephrosis, after an injury, is impossible, is our firm belief However, there are scattered in the literature a certain number of cases in which the truly hydronephrotic nature of the tumor is undeniable Thus Schede says he saw a tumor appear six days after the accident an operation and a post-mortem showed it was a true hydronephrosis Barling's case

is similar, it occurred a few days after the patient had slipped while getting into his bed Fengei's patient had made a violent effort dismounting from horseback, and, last but not least, ten days were enough for a hydronephrosis to appear in one of Richardson's patients after the trifling exertion caused by the rolling of a barrel

FIG 11



(Luys)

The *post hoc, ergo propter hoc*, character of these deductions is obvious. These cases must be construed as cases of latent hydronephrosis discovered because a trauma drew the attention to the loins. The slightness of the injury in many instances makes us suspicious as to its etiological rôle.

But is there nothing that may be called traumatic hydronephrosis and must we scratch the name from medical nomenclature? We do not think so. If a lumbar contusion cannot

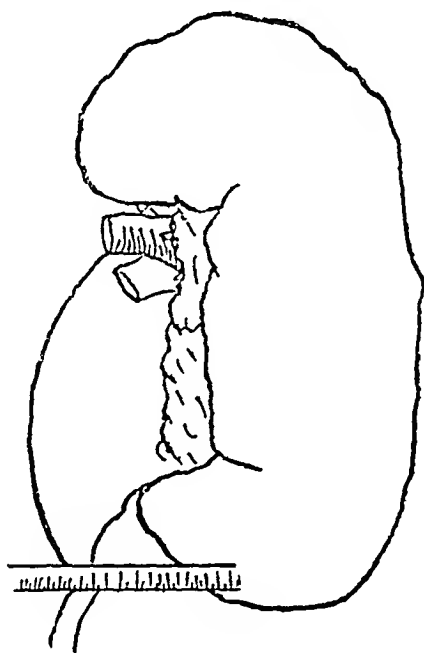
produce hydronephrosis itself, it can very well cause a stricture of the ureter. The symptoms of hydronephrosis will appear after a certain interval, four months, six months, several years. The interval was six months in Dr Gerster's remarkable case which enjoys the distinction of pertaining all at once to a traumatic stricture, to a congenital malformation, to one of the first conservative attempts ever made, and also to the youngest patient on record among those treated by conservation, unfortunately after six months' success, a sinus reopened, pyelonephritis set in and nephrectomy had to be performed. Shall we say, with some writers, that the latter facts are not *traumatic hydronephroses*, but should be styled *hydronephroses secondary to a traumatic stricture* of the ureter? This might be a subtle distinction, if it were more than a mere quibble. If it was sustained, we could call congenital only those cases in which the tumor is fully developed at the time of birth, all others would have to be styled hydronephroses secondary to a congenital lesion of the ureter. Calling, as we do, congenital, all lesions relevant of a congenital condition whatever may be the time of onset of the symptoms, we must call traumatic all retentions caused by a trauma, even if the latter acts only indirectly and tardily through the medium of a stricture. And, to sum up tersely the etiologic rôle of injury in the genesis of hydronephroses, let us say *immediate traumatic hydronephrosis cannot and does not exist, late traumatic hydronephrosis does exist*.

There have been many ups and downs in the history of *calculous hydronephrosis*. In turns, it has been considered without sufficient grounds as very frequent, and its existence has been almost flatly denied.

When a rather large sized stone is found impacted in the ureter while the corresponding kidney is dilated, a natural enough inference is that the calculus is the cause of the hydronephrosis, it was the opinion of all the earlier writers, Rayer, Morris, and was still admitted without dispute by Newman in 1888. The stone was supposed to act either as a valve or a

plug when its size made it unmovable. It is very likely that many hydronephroses described as calculous on the sole strength of the co-existence of an impacted stone, do not deserve the name, but much of the criticism aimed at calculous hydronephroses seems to bear upon secondary questions. Thus Arnould rejects all cases in which the content of the sac is not exactly like normal urine. Such an exclusion is arbitrary, because we know the liquid contained in a hydronephrosis may become reddish, flaky, even turbid, and yet remain sterile. Legueu refuses the name of calculous hydronephrosis to all

FIG 12



(Legueu)

cases in which bacteriological tests have not peremptorily established the perfect asepsis of the contents. This also, although logical, is arbitrary, such a stringent rule may be theoretically right, but practically the difference between a strictly aseptic sac and the same when it is slightly infected, is not so great as will warrant placing those two stages of the same condition in two different classes. There are no such sharp lines in biology. Such requisites cut down Newman's 51 cases to 2 (Antona, Stevenson). But neither Arnould nor Legueu enters into the real merits of the question: can a stone produce an aseptic distention of the kidney, and, if it does, how

does it act? They argue on contingencies and their ostracism is as far from scientific truth as the first observers' hasty conclusions

It is impossible to deny that a stone impacted in the ureter can produce hydronephrosis. Clinically, the causal relation is proved by the cure of retentions after simple removal of the calculus. Experimentally, Ebstein and Nicolaïer produced renal calculi by feeding oxamid to dogs and Tuffier and Navarro, while using the method with other ends in view, obtained incidentally a few retentions.

But the number of calculous hydronephroses, though much higher than thought by Arnould and Legueu, remains nevertheless small as compared with the number of renal and ureteral stones. Hydronephrosis is not the ordinary result of stone impaction in the ureter, atrophy and sclerosis of the kidney is much more frequent, as the general pathology of duct calculi would lead us to think, and as every surgeon who has occasions to see many cases of aseptic lithiasis knows. Therefore, some peculiarities are necessary in order to have a stone cause a retention. Careful analysis of the cases elicits a few of them, but sometimes nothing out of the ordinary is found. For those cases, the old theories are alone acceptable and why should not they be accepted since a partial obstruction is admitted by all surgeons as the only necessary cause for the production of hydronephrosis?

However, there are here no fast rules governing the development of retentions. Neither the shape or volume, nor the number, nor the seat of the concretions, are decisive elements. Hydronephrosis is sometimes seen with stones of the size of a filbert, while there was no retention in Israel's case with a huge ureteral calculus seven inches long and more than one inch in diameter. One stone is enough in many cases, while 16 in a case published by Morris had not caused the pelvis to dilate. Why there should be such variations is not always discernible.

In some reports, the co-existence of a congenital malformation is noted (Fenger, Perkins, Morris, three cases of Léon Bernard). It is more than likely that stone and malformation

helped each other constitute an obstacle, while each one taken separately might perhaps not have impeded the flow of urine.

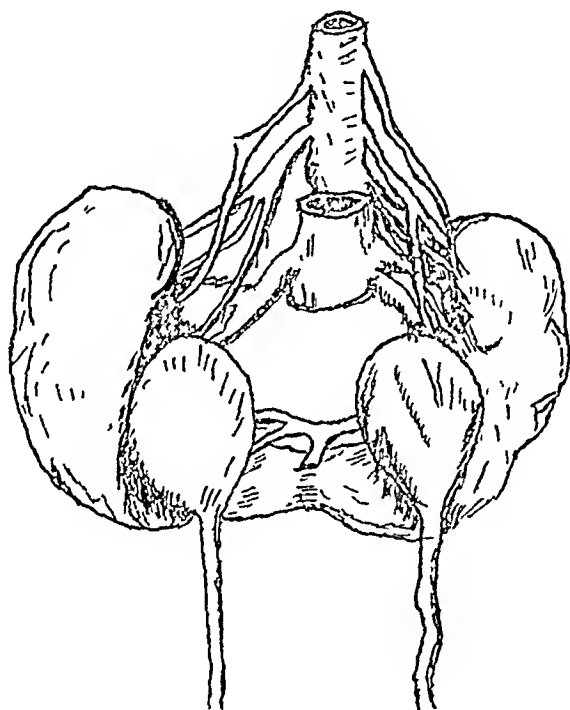
In some other instances, a similar aggravating rôle is played by acquired alterations of the canal. When a stone moves through the ureter, it certainly scratches the walls, and more or less deep traumatic lesions are a natural consequence, despite the statement of many writers that calculi are harmless for the duct through which they are expelled. But in most cases, these lesions heal quickly and well. Sometimes, however, a stricture is the result, when it is formed the next stone will stop there and a sufficient obstruction will be realized. Barker, Israel, Ledentu, Albarran, have seen cases of this type. Bernard has seen, in newborn infants, four calculous hydronephroses caused, not by common stones, but by deposits of uratic sand in the kidney, and he raises the question if some of the supposedly causeless hydronephroses in adults are not sequelæ of an infantile undiagnosed lithiasis. But it is noteworthy that, in three out of his four cases, there were malformations of the ureter and maybe, after all, his were congenital hydronephroses also.

The popping in and out of the stone has been proposed by Lancereaux as an explanation for some cases of intermittent hydronephrosis. It reminds one of an old-time theory of recurrent appendicitis based also on intermittent poppings of fecal concretions. However ingenious the idea, it does not stand examination. We have said that there was no special type deserving the name of intermittent hydronephrosis, consequently we need not dig out of our imagination mechanisms to account for its production.

Inflammatory lesions of the ureter do not rank as frequent causes of hydronephrosis for the very plain reason that if the ureter is infected, the chances are that the pelvis and kidney are also, pyelo-nephritis or pyonephrosis, not hydronephrosis, is the logical outcome. But, if the infective process is slow and very much attenuated, hydronephrosis seems to be a bare possibility. *Ascending tuberculous meteritis* has been incriminated, but cases remain few and far between. To our knowledge, four cases only are on record, all French (Lancereaux,

Albarran, Répin, Legueu) The ureter is sometimes still pervious, but, in the majority of cases, it is occluded. And maybe the name hydronephrosis does not fit exactly those cases, not unlikely, they are healed tuberculous kidneys and distention is only the trace of the old disease. They depend more on destruction of the parenchyma than on distention of the pelvis, and consequently are pseudohydronephroses, akin to renal atrophy more than to real hydronephrosis.

FIG 13



Horseshoe kidney Double uronephrosis (Hauser)

Peri-ureteritis is more important as an etiologic factor. It is very frequent in the upper part, where it changes temporary bends into permanent kinks. It has been stated above that, without the fixity of the upper segment of the ureter, no hydronephrosis could result from kidney mobility. In the lower part, peri-ureteritis is not as frequent, but it is observed sometimes the duct, encircled in a hard fibrous ring is narrowed and possibly deviated from its normal course, the destruction of the band and the straightening of the ureter are needed for a cure of the retention.

Here ends our list of the causes of hydronephroses. The official list still includes curves, kinks, flexuosities, torsions, acquired valvules, oblique and high insertion of the ureter, but these are direct *consequences* of the pelvic distention and not its causes. So thought already Simon (of Heidelberg), the father of renal surgery, and his opinion has been vindicated by Albarran and Leguen's experimental work. All those who have ligated ureters know that the first effect of ligation is a sagging of the upper part of the ureter and the development of flexuosities. Fenger has taught us how the high and oblique insertion of the ureter is a consequence of the development of the retention, as well as the valvule near the ureteral opening, which, it must be noted here, is thoroughly different from a congenital valvule. (See Fenger's diagram, Fig 8.) Torsion has already been referred to.

Such are the views on etiology of hydronephrosis we have derived from the observation of numerous enough cases, which it was our good fortune to see, and from painstaking study of the literature on the subject. Maybe we do not show as exclusive preferences in the choice of our theories as most writers. But what is most needed in the study of the etiology of hydronephrosis is good judgment and impartiality. Strange to say, almost all writers seem to have extreme opinions. Fifteen years ago, almost all hydronephroses were considered as acquired, since the frequency of congenital defects began to be recognized, the wind has shifted and many writers seem now bent on demonstrating that all are congenital, while some few remain staunch uncompromising supporters of the old belief. One way is as unscientific as the other. A theory, even a pet one, ought to always remain subservient to facts. Facts show conclusively that the etiology of hydronephrosis cannot be reduced to the new slogan, "arrest of development," any more than it could be to the old, "kidney mobility." Truth lies midway between extremes, "*Suum cuique*."

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 13, 1908

The Vice-President, DR ELLSWORTH ELIOT, JR, in the Chair

VOLKMANN'S ISCHÆMIC PARALYSIS

DR GEORGE D STEWART presented a boy, 7 years old, who on November 17, 1907, fell, receiving a supracondyloid fracture of the right humerus. A temporary wooden splint was applied at Bellevue Hospital, and the patient was sent home, where he was seen the same evening by the family physician, who reduced the fracture under anæsthesia and applied a triangular splint. On the second day the hand was swollen and blue. The dressings were changed, and it was then noticed that the power of flexion was interfered with. This, however, was attributed to the œdema. After gentle massage, splints were lightly re-applied. Treatment thereafter consisted of daily dressing, with gentle massage, for the purpose of reducing the swelling. On the third day a pressure sore developed on the flexor surface of the forearm, immediately below the elbow-joint. The child suffered a great deal of pain during the first few days after the injury. On December 12, 1907, there was a profuse secondary hemorrhage from the pressure ulcer. Paralysis of the flexors, with inability to extend the wrist and fingers, was then well marked. A week later, Dr Stewart saw the patient in consultation, and made a diagnosis of ischæmic paralysis.

On January 6, 1908, the patient was seen by a neurologist and an orthopædist, who suggested that although the nerves were apparently active, they might be impaired by callus of bone or scar tissue. Accordingly, on January 21, the patient was oper-

ated on by Dr Stewart, and the median nerve was isolated for two or three inches above and below the elbow. Neither at the site of the healed ulcer, nor above or below it did the nerve appear to be compressed, but the muscular tissue had disappeared, and in its place there was a fibrous structure. The patient left the hospital, unimproved. Since that time, under exercise and daily massage, he had improved slightly. His condition, on the whole, however, remained the same.

Examination at the present time showed a typical ischæmic paralysis, as described by Volkmann. In this case, as in the majority of recorded cases, the location of the fracture was in the lower part of the humerus. The causative factors were probably damage to one of the vessels, likely the ulnar, pressure from the lower fragment of the humerus, and pressure from the application of splints. There was marked atrophy of the muscles of the forearm, particularly the flexors, and the muscles had a board-like sensation. Motion at the elbow-joint was very limited, due to the fracture, the forearm was pronated and the fingers were flexed, giving a typical claw-hand appearance. When the wrist was fully flexed the fingers could be extended, when the wrist was extended, however, flexion of the fingers could not be prevented. Forcible extension of the fingers caused the flexor tendons at the wrist to become prominent. Touch and temperature sense had never been impaired. The muscles reacted to both galvanic and faradic stimulation, proving, according to Taylor, that the nerves were not damaged.

The fibrous degeneration which took place in these cases of ischæmic paralysis was no doubt very closely allied to the changes observed in the sternocleidomastoid muscles and contiguous structures in certain cases of so-called congenital torticollis, due to faulty position *in utero*, and a consequent ischæmia.

PRIMARY SARCOMA OF THE APPENDIX

DR STEWART presented a man, 35 years old, a native of Greece, and a peddler by occupation, who was admitted to Bellevue Hospital on January 27, 1908.

Bearing upon his present illness, the patient gave a history of having had three similar attacks. During the first one, which occurred about a year ago, the pain was localized over the appendix, but was not very severe. A second similar attack had

occurred three months ago, and a third one four weeks ago. This was more severe than the previous attacks, and was accompanied by vomiting.

Present illness. On the night preceding his admission, after eating some cheese and olives, the patient experienced a diffuse, dull pain, constant in character, and located in the abdomen. He had vomited five times during the early morning, the vomitus consisting of undigested food, it was sour to the taste, but contained no blood. For the past three or four days his bowels had been constipated. On the day of his admission he had two watery passages which contained no blood. His pain had gradually increased in intensity. On admission, his temperature was 102, pulse, 100, respirations, 24. A blood count showed 16,000 leucocytes, 80 per cent polynuclears, 8 per cent transitionals, 8 per cent lymphocytes, 1 per cent mononuclears. On the following day the leucocytes numbered 12,200, polynuclears, 80 per cent, transitionals, 5 per cent, lymphocytes, 13 per cent, mononuclears, 2 per cent.

Upon physical examination, the patient, who was well nourished and developed, was found lying on the left side with the knees somewhat flexed and the thighs drawn up. There was no vomiting, he did not complain of pain. The abdomen was normal in appearance, the respiratory movement was decreased, with slight general resistance. The upper half relaxed fairly well, the lower half was held more firmly, and deep palpation was resisted. There was a slight spasm in the region of the right lower rectus, where the stiffness was more marked than on the left side. He pointed to McBurney's point as the spot of greatest tenderness and pain. The liver and spleen were normal.

Operation, February 1, 1908. Upon opening the peritoneum, the muscular bands on the cæcum were followed to the tip of that organ, where they disappeared behind the peritoneum, or more properly, behind adhesions. With the finger, a small mass was felt in the ileocæcal angle projecting forwards from the peritoneum on the posterior abdominal wall, and about one inch internal to the cæcum. The mass was taken, correctly, to be the tip of the appendix, and with the finger the supposed adhesions were broken up. The appendix was separated up to its cæcal origin, where it was ligated and removed in the usual way. The

patient's recovery was uneventful, and he left the hospital on February 19, 1908

The pathological report, by Dr Harlow Brooks, was as follows The mass was composed of mingled blood clot, largely absorbed and replaced by a mass of rapidly proliferating spindle- and spider-shaped cells, of a decidedly foetal type supported in a mucoid matrix The tissue was not highly vascular, but the vessels present, for the greater part, were surrounded by an inflammatory infiltration in which eosinophilic leucocytes were notably frequent Many of the fibroplastic cells, some of which were of very large size, contained considerable quantities of dark-brown pigment, presumably of hæmatogenous nature

The mucosa of the appendix was intact, but the other walls were greatly thickened by a mingled growth of adult connective tissue, evidently of long standing, and by infiltrating sarcomatous cells of similar character to those noted in the external mass In one area, these cells extended entirely to the mucosa, and the submucosa throughout was packed with them The lymphoid tissue was for the greater part replaced by either these cells or by fibrils of connective tissue In addition to the neoplastic elements, the smaller vessels were surrounded by inflammatory infiltration, acute or subacute in origin

Occasional areas of necrosis were present, both in the appendix and in the external mass, and the possibility of a syphilitic process had not been overlooked After a careful study, Dr Brooks said he believed that the process was unquestionably sarcomatous, and that the probable primary lesion was in the wall of the appendix, where the malignant growth was perhaps excited by chronic and persistent inflammatory disease He therefore classed the process as a fibrosarcoma of the vermiform appendix

A search of the literature on primary sarcoma of the appendix showed a total of nine cases In only five of these were there authentic pathological reports, three were of doubtful origin, and in one case the original report could not be found The first case was reported in 1895

This case was shown, Dr Stewart said, because of the relative infrequency of the condition, and because it resembled so closely an ordinary attack of appendicitis Indeed, the gross specimen, as well as the history, gave little hint of the true nature of the disease, and the case strongly emphasized the value of routine microscopical examination

DR ELIOT said that about three years ago he published a case of benign papilloma of the appendix, in which the growth completely filled the lumen of the organ It must have existed for a number of years, but never gave rise to any symptoms

until three days before the appendix was removed. The patient had an apparently mild attack of appendicitis, and owing to the persistence of the tenderness, the removal of the appendix was advised. Upon operation, this papillomatous condition was found, the growth closely resembling a papilloma of the bladder.

CARCINOMA OF RECTUM

DR STEWART presented a man, 49 years old, who was born in England, and whose occupation was that of a carpenter. There was nothing important in his family or past history. About two years ago the patient began to suffer from diarrhœa having six or seven loose, watery, yellowish stools daily. After two or three months there was considerable blood and mucus present. He had no pain, only slight tenderness. His diarrhœa gradually increased in severity, and when he was admitted to the hospital he had as many as 24 movements a day, these stools were never formed, and their frequency and consistency was unaffected by diet. He had never vomited, but there was occasional retching, no hæmatemesis. Six months ago he had hemorrhoids, which disappeared under treatment. The abdomen had never been swollen. For the past eighteen months the patient had been losing flesh and strength, but had not stopped work.

Upon examination, about a finger's length from the anal orifice, there was a very tender, firm nodular mass, which had the feel of a much lacerated cervix uteri. An ounce or two of blood was expelled after each examination. The tip of the finger passed into the lumen narrowed by the growth, but not beyond. The patient complained of no pain in the rectum, but had a vague tenderness referred to the lower abdomen. At times, there was slight difficulty in starting micturition, but no urgency, frequency, tenesmus, dysuria nor hæmaturia. His appetite was good, and he slept well.

Operation March 25, 1908. Upon opening the abdomen by the Pfannenstiel method, examination of the pelvic contents showed that the rectum was involved up to the pelvic brim, this included the entire rectum and the lower part of the sigmoid. The meso-cæcum was opened, and the superior hemorrhoidal vessels tied. Following this, both internal iliac vessels were easily ligated. The bowel was then cut in two and clamped, the cautery being used, and a ligature placed on the upper portion. The lower end

was carefully turned in, as it was decided not to attempt to remove the diseased bowel. An inguinal artificial anus, made by splitting the muscular fibres, was then established about an inch and a half from the anterior superior spine, the bowel being well drawn through. (The ligature was left *in situ*, and remained there for three days before its removal, some leakage occurred, however, before the first dressing.) The abdominal wound was then closed.

As the patient was in good condition, it was deemed permissible to attempt removal of the diseased rectum. Accordingly, the patient was placed in the Sim's position, and an incision made beginning down by the side of the coccyx and running forward along the median line to and around the anus, the anal opening having been carefully sutured. This incision was deepened, and to gain additional room the coccyx was removed. Through this incision it was possible, after opening the peritoneum, to reach up and secure the upper end of the lower portion of the bowel. This was turned down, and carefully cut away from the bladder wall, the whole being removed. The perineum was closed by sutures, leaving a large drain and gauze packing. No attempt was made to close the pelvic peritoneum, as this would have been impossible from the perineal wound. In the early part of the operation, during ligation of the iliacs, the ureters were isolated, and subsequently they were dissected well down to the bladder. It was therefore possible, in the part of the operation performed from below, to avoid them easily. At no time was there any hemorrhage, nor was it necessary to secure a single artery. In dissecting the tumor from the posterior bladder wall at the site of the trigone, as the seminal vesicles were involved, it was necessary to place a sound in the bladder to avoid wounding the wall of that organ in this location.

The tumor, upon removal, measured eleven and a half inches. It was examined in the pathological department by Dr. Charles Norris, who classified it as an adenocarcinoma. Since operation, the patient has gained 20 pounds. His abdominal wound healed *per primam*. The perineal wound healed more slowly, but it had for some time been entirely closed. Control of the artificial anus was almost perfect, on some days he had but one movement, on others, particularly if the bowels were loose, he might have two. He stated that his sensations gave him no indication as to whether or not his bowels had or were about to move. Ordinarily, if he

attended to this in the early part of the day, he went unsoiled until the next day. During the first dressings, before the abdominal wound was perfectly healed, in order to protect the wound from soiling, a large sheet of rubber dam was slit at its centre, and this was drawn over the protruding cuff of the bowel, which it fitted snugly. Afterwards, dressings were placed around the opening of the bowel and the rubber folded over from all directions, thus protecting the abdominal wound much more thoroughly and effectively than could be done by the use of Paul's tube and a rubber tube leading away from the bed, or by any other method that could be thought of. Indeed, the attempt to introduce any sort of a tube for the purpose of conducting away the fecal contents was usually unsuccessful, because it was impossible to tie such a tube into the bowel for any length of time without producing sloughing of the bowel wall.

This case was placed on record, Dr. Stewart said, (1) because it was believed that the choice between an inguinal artificial anus and one placed according to the Kraske method, or some modification thereof, was still an open question which could only be decided from the records of a large number of cases, (2) to call attention to the easy control of hemorrhage by resorting to ligation of the internal iliac artery.

TRAUMATIC APHASIA FROM CONTRE COUP

DR. HOWARD LILIENTHAL presented a man, 38 years old, a native of Russia and a painter by occupation, who was admitted to Mt. Sinai Hospital on November 5, 1907. The history obtained then was that about two months prior to admission he had received an injury of the right side of the head, with fracture of the skull, that he had remained senseless for two weeks after this injury and that upon regaining consciousness, he was completely aphasic. This, with the exception of pain in the head over the region of the injury, and some weakness in the right arm and leg, was practically his only symptom. There was no history of convulsions, no paralysis, no difficulty in swallowing. There was no depression over the site of the original fracture, which had been operated on at the Eastern District Hospital. It was ascertained that prior to his injury he could read, write and spell fairly well, and had been intelligent enough to carry on his business as a boss painter, making out his own accounts,

etc. The only word he could now speak was the German word "alles," and this was his invariable reply to all questions put to him, although he understood them perfectly. For example, when a key was handed to him he would call it "alles," but he was able to draw a picture of a key and indicate its use.

The patient was examined from a neurological standpoint by Drs. Sachs and Abrahamson. Dr. Elsberg, Adjunct Surgeon, also spent much time in careful observations of the case. A diagnosis of probable hemorrhagic cyst was made, located over the left Rolandic area, and due to *contre coup*. The aphasia pointed to a lesion of the Broca convolution, and craniotomy in that region was advised. The operation was done by Dr. Lihenthal on November 8, 1907. Upon opening the skull over the left Rolandic fissure, the pia was found to be very adherent to the brain. Upon incising the dura, a small quantity of serous fluid escaped, some of this was collected for examination, and was reported as degenerated brain tissue. The lesion found was regarded as a broken down cyst.

There was no improvement in the man's speech subsequent to the operation. Since then, systematic efforts had been made to teach him to regain his lost power of speech, beginning with rudimentary methods, but instead of teaching him German, which was his natural language and in which he was most proficient, the instruction was entirely limited to English words, with the idea of demonstrating, if possible, the correctness of the physiological theory that when the word-centre was destroyed, as it apparently had been in this case, the adjacent brain cells, or perhaps the corresponding centre on the opposite side of the brain, would take up the work. The patient was now able to speak English fairly well. He understood German,—as he did before the operation—but with the exception of the one word, "alles," he was unable to speak in that language.

DR. CHARLES A. ELSBERG, who has seen the patient both before and after the operation, said he had been very much interested in watching the order in which the speech and reading power had returned in this case. In learning the alphabet, he was first able to recognize and pronounce certain consonants, such as "p" and "b." Then came "t" and then "s," and after that he learned the vowels and the other letters of the alphabet. It was quite some time before he was able to read words, and at

first only very simple words In the beginning he was often unable to pronounce the word He often could pronounce parts of a word, but not the entire word

DR I ABRAHAMSON, who had studied the case in Dr Sach's ward at Mt Sinai Hospital, said the patient had recently had several attacks of Jacksonian epilepsy beginning in the right face, and in each instance these were followed by a temporary loss of his newly regained power of speech The case was apparently one of cortical motor aphasia with a distinct focal lesion of Broca's area due to a trauma on the opposite side of the skull, resulting in practically complete motor aphasia and a slight degree of faciobrachial monoplegia The temporary retrocession of speech occurring after the attacks of Jacksonian epilepsy, involving the right face, apparently disproved the theory that the impaired function of the left word-centre had been taken up by the opposite side of the brain In connection with his remarks, Dr Abrahamson gave a schematic representation which explained in detail the various components of the aphasia in this case

SUPPURATING HYDATID LIVER CYST COMPLICATING CHOLELITHIASIS

DR LILIENTHAL presented a man, 33 years old, who since childhood had suffered from attacks of biliary colic, never, however, associated with jaundice He came under Dr Lilienthal's observation in November, 1907, and was operated on at the Mt Sinai Hospital on November 25th for what was thought to be a cholelithiasis, as a hard mass was felt prior to operation in the region of the gall-bladder Upon opening the abdomen, a pericholecystic mass was found, with a single large stone in the gall-bladder The stone was removed, and the hard mass was incised it was found to contain pus, which was evacuated through the gall-bladder The patient's wound failed to heal, and several weeks after the operation a small hydatid cyst was evacuated through the sinus, which continued to drain freely for about two months, enormous quantities of fluid and numerous small and large cysts escaping Two ribs were then resected posteriorly, and a counter-opening made on a probe pushed down to the point This exposed a large hydatid cyst containing calcified plates, showing that it must have been there for a long time Two handfuls of these plates were avulsed, and then a tube was run through

from front to back This second operation was done on March 4, 1908, and the patient left the hospital about a fortnight later He was now practically well, although there was still a slight discharge from the wound¹

In reply to a question, Dr Lilienthal said the pleura in this case was simply pushed upwards—not opened

DR GEORGE E BREWER said that in one case of hydatid cyst which he was unable to remove or completely empty excepting through long-continued drainage, he brought about death of the daughter cysts by injections of silver nitrate solution, beginning with a strength of 1-8000 and gradually increasing it to 1-500 This practically sterilized the cyst

ŒSOPHAGEAL DIVERTICULUM

DR GEORGE E BREWER presented a woman, aged 78 years, who was admitted to the Roosevelt Hospital in March, 1908, suffering from difficulty in swallowing, with progressive loss of weight and strength The history of her trouble dated back some nine years, at which time she began to have difficulty in swallowing large particles of food This condition gradually became more marked, so that she was obliged to masticate with greater care, and to exclude from her diet many articles of food which were formerly swallowed with ease About two years ago she began to experience difficulty in swallowing fluids In attempting to swallow rapidly, there would occur a spasmodic closure of the pharynx, with regurgitation and coughing She was obliged to swallow only a very small amount of fluid at a time, and several efforts would be required to accomplish the result About this time she noticed occasional regurgitation of a mouthful of glairy mucus During the past six months, the patient has been unable to swallow any solid or semi-solid food, and has had increasing difficulty in swallowing fluids She has lost between 20 and 30 pounds in weight, and the efforts in swallowing are almost invariably accompanied by pain and vomiting On examination, nothing unusual could be determined by inspection of the neck or pharynx On attempting to pass an œsophageal bougie, it was arrested at a point eleven inches from the incisor teeth After a number of attempts, a small bougie

* NOTE.—At present writing, May 26, wounds are soundly healed

(about 20 mm in circumference) was passed along the right wall of the pharynx, below the obstruction into the stomach. This was followed by several larger sizes, which would pass into the stomach if the point was slightly bent and kept closely in contact with the right lateral wall. On attempting to swallow a glass of water, the patient would bend the head well to the right side and would make several distinct attempts before a drachm of the fluid would pass into the stomach, and it would require about fifteen minutes effort to succeed in swallowing four ounces of water or milk.

Several X-ray examinations were made after the patient had swallowed a quantity of bismuth paste. These were not particularly satisfactory but demonstrated the presence of a pouch apparently situated to the left of the œsophagus, opposite the upper border of the cricoid cartilage. As the patient presented evidences of marked weakness on account of the long-continued absence of nourishing food, and as there was well-marked evidence of arterial sclerosis and chronic nephritis, the danger of any operative procedures was fully discussed with her and her family. As her condition was distressing in the extreme, and as there was little or no likelihood of improvement without operation, she decided upon radical surgical treatment.

Under scopolamine, morphine and ether anaesthesia (the rectal method), an incision was made along the anterior border of the sternomastoid muscle from the greater cornu of the hyoid bone to a point well below the cricoid. The various tissues were then separated and retracted until the lateral wall of the œsophagus was exposed. It was found that about the junction of the pharynx and œsophagus there was an oval protrusion about the size of a robin's egg which could be made to descend along the lateral wall of the œsophagus by the introduction of a bougie from the mouth. An opening was made through the centre of this pouch, and the finger introduced into the œsophagus. On attempting to pass the finger downward, a marked narrowing of the tube was noted about on a level with the lower border of the diverticulum. On retracting the edges of the diverticulum wound, this stricture seemed to be made up of a thin fibrous ring which gave the appearance of a symmetrical narrowing, such as would be produced by the tying of a string tightly about the tube. This ring was divided into two parts and thoroughly dilated with the index finger, after which the diverticulum was removed by

an elliptical incision, and the œsophageal wound closed by two layers of sutures. As the wound had been greatly contaminated by secretion from the pharynx, its upper two-thirds were closed by layer suture, and a cigarette drain left in the lower angle. Practically no reaction followed the operation, although the wound was moderately infected from the first. Nothing was swallowed for five days, although she received an abundance of salt solution and peptonized milk by the rectum. On the fifth day she was given a little sterile water to swallow, and the next day she took a quantity of milk, and the rectal feeding was discontinued. During the second week she was able to take custard, junket, cereals and soft puddings, and before she left the hospital she swallowed with ease beef steak, roast beef and potatoes, and in fact any kind of solid food. At no time was there any leak from the œsophageal wound. At present she is able to swallow all kinds of food and experience no discomfort whatever.

SUPPURATIVE TENOSYNOVITIS OF FLEXORS OF HAND
AND WRIST BIER'S HYPERÆMIA MULTIPLE
INCISIONS

DR CHARLES H. PECK presented a woman, aged 40, who had pierced the pulp of the right thumb with a cod-fish bone four days before her admission to the French Hospital on April 20, 1908. No attention was paid to the wound until that night, when there was severe throbbing pain in the thumb, with slight swelling. The pain, swelling and extension of the inflammation up the arm continued, in spite of a small incision which was made by her physician, and when admitted to the hospital there was tenderness and swelling along the flexor aspect of thumb, and over the great palmar bursa at the wrist. Temperature on admission was 101.2, pulse, 136. No enlarged axillary glands. The leucocyte count on April 22nd was 57,000. Under ether, the incision in the ball of the thumb was enlarged, and an incision over the flexor aspect of wrist was carried directly into the great palmar bursa. Little pus was obtained, cultures showed growths of both streptococcus and staphylococcus aureus. The wound at the wrist was packed. On April 22nd, two days later, an incision was made on the flexor aspect of the forearm, upper third, and packed with gauze.

The Bier's constriction was applied for the first time, two hours in the morning and two hours in the afternoon. The tem-

perature was 102 The next day the bandage was applied eight hours in the 24, and on April 24th, 18 hours in the 24 The wounds were suppurating more freely, the packing had been omitted altogether, the fingers were moved each day at the dressings, and the pus gently pressed out of the incisions The leucocytes were 38,500, temperature, 101 From this time until April 29th, when the temperature reached normal, and the leucocytes were down to 21,500, the constricting bandage was left on the arm from 14 to 20 hours out of the 24 The suppuration extended down the little finger tendon, and incisions were made under cocaine along its course on April 26th On April 27th another incision was made under cocaine on the flexor aspect of forearm, middle third, and pus evacuated from the deep muscular planes, also an incision in the thenar eminence down to the flexor tendon of the thumb

Altogether, eight short incisions were made from April 20th to April 27th No packing was used after the first three days The constricting bandage was applied, as described, from April 22nd to May 1st, nine days in all Wet dressings of weak bichloride solution were kept on constantly, and the wounds were dressed daily with gentle pressing out of the pus, and passive motion of the fingers Suppuration had practically ceased by May 1st, eleven days after the first incisions, and nine days after the first application of the bandage, the temperature remained normal after April 29th There was no tendon sloughing, and the patient is rapidly regaining motion in both fingers and wrist Healing is complete, excepting for two small granulating areas on the forearm, and one on the ball of the thumb

DR WILLY MEYER said the case shown by Dr Peck proved the correctness of Bier's statement that gauze packing of the involved tendon sheaths was apt to be followed by necrosis Bier contended that the same thing occurred in acute bone inflammation and periosteitis and osteomyelitis Dr Meyer thought it was unnecessary to apply the Bier hyperæmic treatment in a case of subcutaneous phlegmon, unless, perhaps, from a cosmetic standpoint, free incisions and drainage usually sufficed But when it came to the preservation of function, and especially in such an acute case as the one shown by Dr Peck, then Bier's hyperæmic treatment was indicated, no matter how much time or trouble it involved The incisions in these cases were made to overcome

suppuration, the hyperæmic treatment to overcome inflammation. As long as tenderness and temperature persisted, we could feel assured that pus was still somewhere and this should be evacuated. Some time after the wound had closed, the hot air treatment would be found beneficial to overcome stiffness and œdema.

SARCOMA OF THE OVARY IN A CHILD

DR JOHN F ERDMANN presented a girl of thirteen and a half years, who came under his observation in August, 1907, with the diagnosis of a probable appendicitis. She complained of pain in the abdomen, and had a temperature of about 100. A large, painful, movable mass could be felt in the abdomen, extending well up above the umbilicus. Prior to the operation, which was done on August 5, 1907, Dr Erdmann said he regarded the tumor as a cyst. On opening the abdomen, he found a large, pultaceous mass springing from the left ovary, with the pedicle twisted, and associated with it was a mass of the omentum. The growth showed all the evidences of strangulation, during the removal the sac ruptured. The peritoneal cavity was cleaned as thoroughly as possible. At the time he found implantation secondary growths. Dr Harlow Brooks reported as follows:

"Free hand sections of the large ovarian growth show the body of the growth to be well localized by a relatively thick membrane of newly formed connective tissue, derived apparently from the ovary, although this membrane has been infiltrated by the new-growth cells which in part enter into the make-up of it. Still, it seems to me that the malignant characteristics do not extend through this sheet. The central portions of the tumor, notably the grayish-white semimucoid material, proves to be made up of a stroma of connective tissue, into the make-up of which embryonic cells largely enter. These cells merge into other cells which are mostly found in semi-acinar arrangement, and which appear to be epitheloid in nature. The blood vessels are not very numerous, but many of them are made up of walls, into the make-up of which the neoplastic cells enter. A diffuse hyaline or mucoid degeneration seems to have involved both epitheloid and connective-tissue structures, and in some places the growth closely resembles a myxoma. The growth is histologically sarcomatous, but like many similar growths of the ovary, especially in the young, epitheloid elements, though of course embryologically entodermal or mesodermal, enter largely. I am inclined to consider the growth a sarcoma, although of a rather low grade of malignancy, and it may not return if it was possible to remove it entirely. In fact, it seems to me that these early sarcomata of the ovary are clinically more like teratoma than sarcoma such as we meet in other parts of the

body Of course, if local or vascular infection has already taken place, the prognosis cannot be otherwise than bad"

The patient left the hospital within a fortnight after the operation, and when she returned, a few days ago, she had a tumor, almost the size of a foetal head, springing from the scar of the operation, the tumor was firmly fixed, and apparently involved the uterus, peritoneum and abdominal wall

TWO PERFORATIONS OF A GASTRIC ULCER WITHIN SIX MONTHS

DR GEORGE E BREWER presented a man, aged 21, who was admitted to the Roosevelt Hospital in October, 1907, suffering from acute pain in the epigastrium, vomiting, and great prostration There had been a previous history of gastric ulcer for two and a half years The present attack occurred on the morning of his admission On examination, there was moderate tenderness of the abdomen, and board-like rigidity over the upper right quadrant, the point of greatest tenderness seemed to be in the region of the pylorus There was moderate elevation of temperature and pulse The patient seemed greatly prostrated He was immediately prepared for operation On opening the abdomen a quantity of free fluid escaped On examining the stomach, an extensive induration was found at the pylorus, in the centre of which a perforation had occurred which allowed the free escape of gas and gastric contents There was a moderate amount of adhesive peritonitis in the neighborhood, and a quantity of turbid fluid seemed everywhere present in the peritoneal cavity The perforation was closed by a purse-string suture of silk, and the peritoneal cavity washed out with a large amount of normal saline solution The wound was closed without drainage, and the patient made an uninterrupted recovery When he was discharged from the hospital, he was able to eat solid food with little or no discomfort

Four weeks ago the patient was again admitted to the hospital, suffering from acute epigastric pain and tenderness He stated that for the past month he had had more or less pain after eating, with sour eructations and occasional vomiting On examination, the upper half of the right rectus was rigid, there

was moderate rigidity of the upper half of the left rectus, with marked tenderness over the entire epigastric area. Temperature, 100, pulse, 84, and of good quality. He was immediately prepared for operation, and at 9 A M., just four hours after his first symptom, the abdomen was re-opened and another perforation found almost in the same position as the original one. This was closed by a purse-string suture, and as the induration at the pylorus seemed greater than at the first operation, and as the patient was in exceedingly good condition, a gastro-enterostomy was performed by the no-loop suture method. The upper abdomen was irrigated with normal salt solution, although there was little or no evidence of foreign material in the peritoneal cavity. The wound was closed without drainage. No reaction followed the operation, and he made an uninterrupted recovery.

BACKWARD DISLOCATION OF THE ELBOW, ULNAR PARALYSIS

DR F KAMMERER presented a young woman who had come under his care in August, 1907, suffering from a backward dislocation of both bones of the forearm, of three weeks' standing. All attempts at reduction under anæsthesia failed. A longitudinal incision was thereupon made over the posterior surface of the elbow-joint, exposing the latter freely. Reduction was then accomplished with some difficulty, although during the necessary manipulations to effect the same, the cause which had prevented prior reduction was not ascertained. The extreme tip of the coronoid process had been torn away. Re-dislocation of the forearm frequently occurred during further manipulation. The wound was entirely closed, and after several days, when primary union seemed assured, a plaster-of-Paris dressing was applied with the arm flexed at a right angle. The joint-surfaces were in normal position at the time.

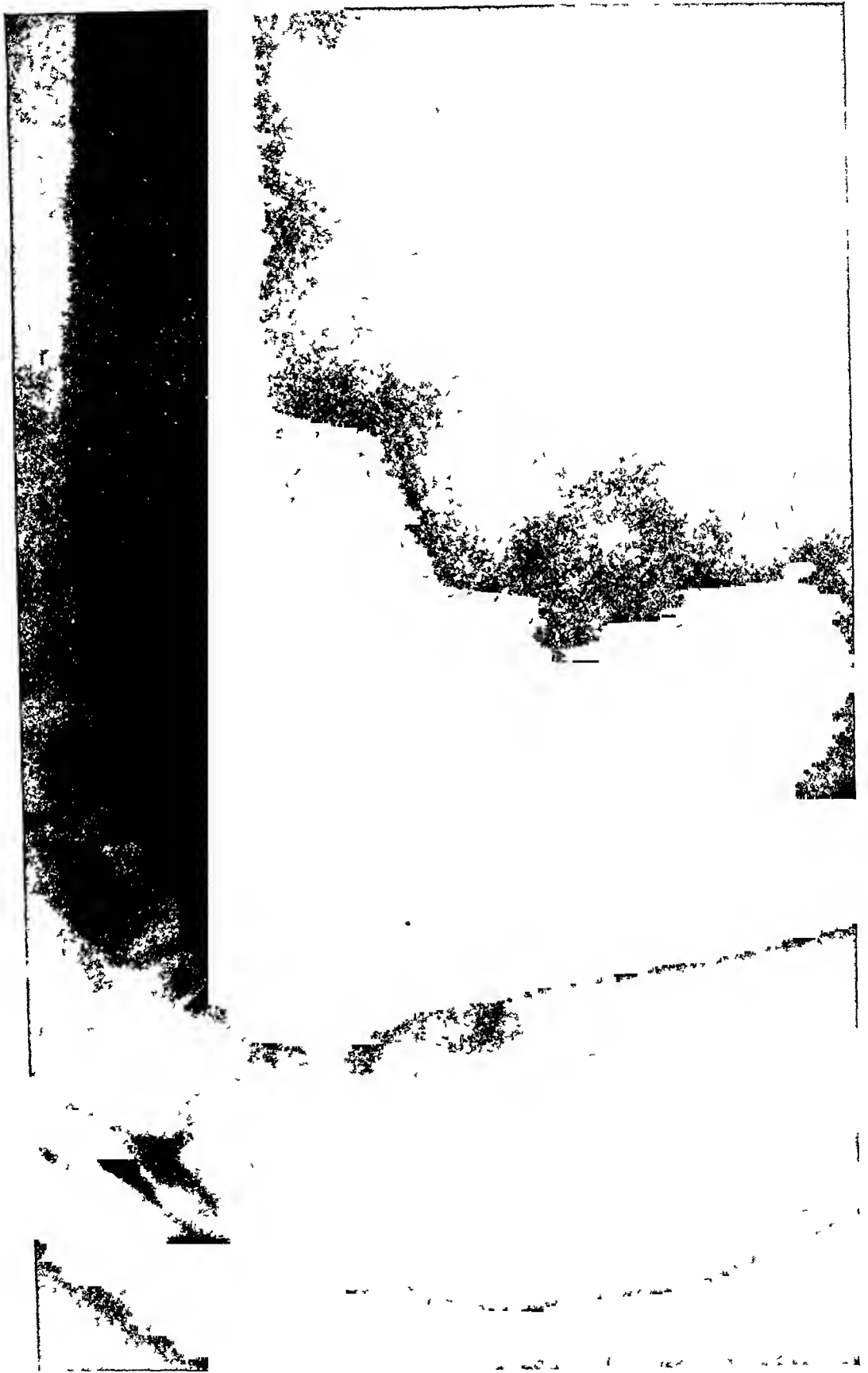
On the day after operation a paralysis of the ulnar nerve, not complete, was noticed, which rapidly grew worse and in a few days the typical picture of complete loss of motor and sensory function of the nerve developed. Upon removal of the plaster-of-Paris dressing, three weeks later, it having become somewhat loose, it was seen that both bones of the forearm were again dislocated backwards. The joint was again opened in the old

cicatrix, the bones forced back to their normal position and a long nail was driven through the olecranon into the humerus, with the arm again bent at a right angle at the elbow (see X-ray picture, Fig 1) A plaster-of-Paris dressing was again applied for four weeks, from which the head of the nail protruded. The latter was pulled out at the end of the second week. Meanwhile, the muscles supplied by the ulnar nerve atrophied, and the hand assumed the well-known *main en griffe* position. After removal of the dressing, the bones were found in their normal relation to one another, and active and passive movements were begun. About five months after the injury, the ulnar paralysis having shown no improvement, an incision, about six inches long, was made over the nerve, and the latter exposed in the entire length of the incision. Special care was taken to follow it along its course through the flexor carpi ulnaris muscle. At no point was a lesion of the nerve detected, and nowhere did it appear atrophied. The incision was closed. A few days after this operation sensation began to return, and in a few weeks the atrophied and paralyzed muscles began to resume their function. This operation was done on January 11, 1908, and at present the sensory and motor symptoms have almost entirely disappeared. The forearm can be flexed beyond a right angle, and extension is possible almost to the full extent, pronation and supination were somewhat limited.

Dr Kammerer said he was unable to account for the lesion of the ulnar nerve. He naturally thought some injury had been done during exposure of the joint and the dissection of the soft parts from the internal condyle of the humerus, but this was disproved by the dissection of the nerve later on. The necessary lesions of the joint surfaces by the nail had evidently not in the least interfered with the further function of the elbow-joint.

Dr ELIOT said he had had a case similar to the one shown by Dr Kammerer, with ulnar paralysis, which was relieved by exposure of the nerve and resection of the internal condyle. In another case of paralysis after fracture of the neck of the radius, almost immediate improvement followed the removal of callus which pressed against the posterior interosseous nerve. In that instance the improvement was just as striking as in the case of Dr Kammerer's.

FIG 1



Skiagraph showing fixation by nail of ulna to humerus to overcome persistent tendency to backward dislocation

CHYLE CYSTS OF THE MESENTERY

DR WILLIAM B BRINSMADE read a paper with this title for which see page 565

In connection with his paper, Dr Brinsmade showed a patient illustrating the condition described

DR CHARLES N DOWD said that a few years ago he had presented to the society a case which suggested several points about the formation of mesenteric cysts. The cyst, which closely resembled an ovarian multilocular cyst, had no epithelium in the wall of the largest chamber while in the smaller chambers there were distinct epithelial linings. The absence of an epithelial lining therefore did not at all mean that there had never been such a lining—just as in parovarian cysts the small ones have epithelial lined walls and the large ones have lost their epithelium through pressure—so in mesenteric cysts the epithelium has often disappeared. In the cyst which he had presented the content of the different chambers too had been different, some containing blood, others clear fluid. This cyst was manifestly of embryonic origin, from an ovarian rest, and there were many reasons for believing that most of the mesenteric cysts were also of embryonic origin, the content of the cyst depending in a measure on its location. If it was located among the lacteals it was easy to believe that chyle might exude through the wall of a compressed vessel and find its way into the cyst cavity, in fact it was much easier to believe this than that a cyst should result from the simple occlusion of a lacteal vessel. One hardly understands why the occlusion of a lacteal should result in a chyle cyst any more than the occlusion of a leg vein should result in a blood cyst. The anastomosis is too abundant and the internal pressure too slight to make such formation easy.

Ducasset had reported a case in which some loculi contained yellow serous fluid with no evidence of chyle and others contained white chylous fluid. Demon had also reported a multilocular cyst in which one chamber contained blood and the others chylous liquid. Kuster described a chylous cyst which was lined with epithelium and Pagenstecher one in the fluid of which degenerated flat epithelial cells were found.

We may be misled by the statistics of recoveries from the simple drainage of these cysts. The later histories were not given

and we do not know how many of them refilled. We do know, however, that many of the ordinary cysts, which are simply drained, refill at a later time. Hence in dealing with these cysts it seems wise to remove at least some of them.

SUPRAPUBIC PROSTATECTOMY

DR JOHN F ERDMANN showed eight specimens of exceptionally enlarged prostates which he had removed during the past few weeks. In all of these cases the operation has been done by the suprapubic route, which the speaker said he now favored in practically all cases, in preference to the perineal

REAMPUTATION OF LOWER END OF LEG FOR EXOSTOSIS IN A PREVIOUS BIER AMPUTATION

DR JOHN F ERDMANN presented a specimen of reamputation of the leg at the upper and middle thirds necessitated by an exostosis between the end of the tibia and the Bier flap. This occurred in a man 41 years of age, whose leg had been amputated by the Bier method in one of the New York hospitals subsequent to a trauma. Some few months after the amputation the patient observed that the skin over the end of the stump was becoming taut and ulcerated. He was seen by Dr Erdmann, who advised reamputation, owing to the fact that the stump was decidedly conical and the skin covering it drawn very tightly, while at the apex an ulcer the size of a half-dollar existed. Upon dissection of the stump by Dr Erdmann it was found that the thin Bier flap had been pushed three-quarters of an inch away from the tibial end by the filling in with ossific or calcareous tissue.

Dr Erdmann stated in showing this specimen that he presented it with a view of showing one of the dangers of the Bier flap.

DR WILLY MEYER, in discussing the last specimen shown by Dr Erdmann, said the patient referred to had been under his care for almost two years. The original injury to the leg was sustained in a railroad accident, with far-reaching blood invasion between the muscles, etc. Amputation became necessary and he did the osteoplast method. The periosteum of the tibia was also much suffused with blood. A partial necrosis of the bone-flap followed, but the wound healed at last. The patient was very restless and put the artificial leg on too early, so that there was now and then superficial soreness. He had intended to transplant a skin flap from the other leg in order, according to X-ray pictures, to preserve the bone-plasty, which had proved a success.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting Held May 4, 1908.

DR. G G DAVIS, in the Chair

HÆMOPHILIA TREATED BY TRANSFUSION

DR FRANCIS O ALLEN related the history of a boy of twelve, who was admitted to the Presbyterian Hospital a year ago, with a history of having bled from the mouth for four days previously. The bleeding had been profuse.

On admission, the patient was comatose, very pale, the skin was flabby and waxy, and a thin stream of blood was oozing from the mouth.

He was treated for two days with various drugs and with saline solution subcutaneously. The oozing continued, and the boy became weaker and more deeply unconscious. The hæmoglobin on the day of admission would not register on a Hare hæmoglobinometer, which does not register below ten. The resident physician estimated it as four. The next day it was estimated as five. The blood from the mouth tinged the pillow-case a pale yellow.

The second day after admission, Dr Stryker, in whose care the boy was, asked Dr Allen to transfuse the child. This was accomplished after much trouble, an uncle of the child consenting to be the donor. The technic was bad, owing to a lack of the proper instruments. The boy must have received only a small amount of blood, but how much it was impossible to state. During the operation, his mental condition changed, becoming bright enough for him to complain of pain and call the doctor hard names.

Two days after the operation, the hæmoglobin had risen from five to fourteen, and the red cells from 1,060,000 to 1,240,000. The bleeding stopped after the transfusion, but recurred slightly at intervals for the next five or six weeks. The hæmoglobin continued to increase.

On the 4th of June, one month after admission, the hæmoglobin registered sixty-eight, and the red cells 3,930,000. The boy was discharged in good condition the only thing observable being that the teeth were carious and very irregular. It was almost impossible to tell where the bleeding came from, at times it seemed to come out of the teeth themselves, two of which were mere shells, at other times, it seemed to come from the edge of the gums.

The boy has been back to the hospital three or four times since. During the past winter he was admitted with hæmoglobin registering fifteen. He was not transfused on this occasion, but treated medically. The hæmoglobin gradually rose. Two or three weeks ago he was in fair condition, although he had one swollen knee-joint, and there was a slight oozing from the gums on the least provocation.

HEMORRHAGE FROM THE BOWEL FOLLOWING APPENDECTOMY

DR CHAS F MITCHELL related the history of a woman, aged twenty-six, who was admitted November 14, 1907, to the surgical ward of the Pennsylvania Hospital under the care of Dr J P Hutchinson, with the following history.

Previous history negative. menses began when she was seventeen years of age, always regular, lasting four or five days, painful at times. No vaginal discharge. Has been married three years, and has had three children. Thinks she had a miscarriage about six weeks ago. Never was troubled with hemorrhoids or bleeding from the bowel, previous to admission.

Came to the hospital complaining that for the past six weeks she had almost constant bleeding from the vagina. When not bleeding there was a mucopurulent vaginal discharge present.

Physical Examination. Heart and lungs normal, slight tenderness noted in right lower quadrant of abdomen.

Vaginal Examination. Rather profuse vaginal discharge, not bloody. Cervix not dilated, uterus slightly movable. To the

right of the uterus, a firm rounded mass felt, apparently connected with, but not continuous with the uterus Mass not tender

Urine examination negative

Diagnosis—Right-sided salpingitis with adhesions

November 19th, under ether narcosis, a median laparotomy was performed, the pelvic mass to the right of the uterus was found to be a hæmatosalpinx, which was tightly bound down by adhesions, the appendix being included in the mass Left tube and ovary perfectly normal After the adhesions were broken up, the mass which was made up of the right tube and ovary, was removed The adherent appendix found to be very much inflamed, and was also removed, the stump of appendix first being crushed, and then turned in by means of a catgut purse-string suture

Temperature immediately before and after operation was 98°, pulse 100 Patient did well until midnight, eleven hours after operation, when she became restless, complained of feeling faint, face became pallid, temperature dropped to 96.2°, and pulse became so weak and compressible that it could not be counted There was no sweating It was thought that a secondary hemorrhage had occurred, probably from the stump of the excised tube The patient was again etherized, and the abdominal wound reopened, pelvis found to be perfectly dry, and no evidence noted anywhere of bleeding having taken place within the peritoneal cavity

The stump of the appendix was then examined, but there was no sign of any bleeding at this region, the cæcum and colon being empty and collapsed It was then noticed that the coils of small intestines about the umbilical region had a peculiar bluish color, were partially filled with fluid, which at the time was thought to be bloody in character As the patient's condition was not good, no further exploration was made to locate the bleeding point or points, and before being removed from the operating table she was given intravenous injection of normal salt solution Immediately after operation temperature was 97.2°, pulse 160

November 20th, 5 A M A little over four hours after the second operation, although still pale condition was fairly good Temperature was 100.1, pulse 160, respirations 24 At 5 P M of the same day temperature was 98.4, pulse 124

November 21st Enema to-day brought away a large bloody stool, the blood being of a dark red color and mixed with fecal material. Later in the day passed three more stools, all of which contained blood.

November 22d Had two stools to-day, both of which were made up principally of blood. Hæmoglobin 44 per cent, leucocytes 7250. Altogether there have been six bloody stools, unable to estimate exact amount of blood.

December 1, 1907 Eleventh day after operation, hæmoglobin 67 per cent.

December 6, 1907 Discharged from hospital to-day.

Dr Mitchell added that during the last few years a number of cases of hemorrhage from the bowel following operations for appendicitis have been reported, the cause of this postoperative catastrophe being laid to some faulty technic of the operation. In a few of the reported cases the appendix stump was undoubtedly the site from which the bleeding came, as was proven either by secondary operation or post-mortem examination, but in the majority it was merely assumed that the bleeding came from the seat of operation.

He reported this single case to place on record a case in which the appendix was removed, the stump inverted by catgut purse-string suture, the operation being followed by severe hemorrhage from the bowel, which did not come from the inverted appendix, as was demonstrated by the secondary operation.

Dr Wyeth¹ mentions in his paper on "Technic of Appendectomy," sixteen cases where the stump of the appendix was inverted, and which were followed by bleeding from the bowel, presumably from the stump of the appendix. In six of the sixteen cases was it clearly proven, by operation in five, and post-mortem examination in one, that the hemorrhage came from the stump of the inverted appendix. Thirteen of the sixteen cases recovered and three died.

Judd² reports an interesting case, which in many respects is similar to the case just reported. In his case the appendix was removed and the stump inverted by means of a silk purse-string suture. Eighteen hours after operation the patient complained of severe abdominal pain, and shortly afterwards passed by

¹ Journal American Medical Association, vol xlix, pp 121-1907

² Journal American Medical Association, vol xlix, pp 1843-1907

rectum about twenty ounces of bright red blood. During one hundred and forty-four hours succeeding the operation, passed fifty-eight ounces of blood. This patient was treated by morphine, quiet, no food, making an uninterrupted recovery, and was able to leave the hospital on the eighth day. In conclusion Dr Judd says "In this case the absence of any oozing from the stump was noted at the time of operation. It has always been my practice to clamp and tie with catgut any bleeding points before inverting the stump. In this case it seems incredible that such a hemorrhage should follow an operative procedure where the field was so dry, and in pondering over the subject it has occurred to me that some other explanation than bleeding from the stump is necessary to explain the cause."

I fully agree with Dr Judd that it is most probable the hemorrhage in his case did not come from the appendix stump, but of course this fact was not proven. Its similarity to the case now reported suggests that the cause of the bleeding was the same in both cases.

It is a well established fact that bleeding from the stomach or bowels or from both, may follow any major operation. Busse³ reports fourteen cases of his own, and eighty-two similar ones collected from the literature of the subject, in which bleeding occurred from the stomach or duodenum after abdominal operation. The mortality in this series of ninety-six cases was fifty-five per cent.

The pathological changes which take place after the various abdominal operations and give rise to the bleeding, either from the bowel or stomach, have not as yet been satisfactorily explained. A number of theories have been advanced, however, to explain this condition. Mr Moynihan in his book on abdominal surgery, states that hæmatemesis may follow any abdominal operation, but is more especially to be looked for when the stomach, duodenum or bile-passages are the seat of disease. He mentions five theories as possible causes of hæmatemesis, which may hold good to explain bleeding from the bowel after operation, as well as from the stomach.

The five theories are as follows (1) The anæsthetic, (2) distinct injury to the stomach or bowel, resulting in ulceration

³ Archiv für klinische Chirurgie, 1905, p 1568

from which the blood comes, (3) (Von Eiselsberg) injury to the omentum, rough handling, twisting or ligating of the omentum, producing a thrombosis of the omentum, which is followed by embolism in the walls of the stomach or bowel, (4) sepsis (Dr W L Rodman's theory), (5) reflex nervous influence (Mayo Robson)

Mr Moynihan personally believes that Dr Rodman's theory of sepsis is the correct one, and in support of this theory says "This seems to me the most likely of all the explanations that have been given, though it cannot be denied that in some instances the obvious evidence of sepsis is wanting. In some of these cases it may be that the sepsis is of such a character as to produce a rapidly fatal toxæmia, the poison acting so rapidly indeed that local evidences, peritonitis, etc., have no time to develop

Of the five theories just mentioned, that of sepsis, as suggested by Dr Rodman, seems to the reporter to be the most feasible. In a few cases the bleeding may come from pre-existing gastric or duodenal ulcers, but in only a few instances can the cause be laid to these pre-existing conditions

DR ASTLEY P C ASHHURST said that he had never felt convinced that the majority of the cases reported by Wyeth were really due to hemorrhage from the stump of the appendix, for it has been known for some time that the French pathologists, especially Dieulafoy, have called attention to the black vomit of appendicitis. It is probable that a good many surgeons have seen this black vomit without realizing what it was. The appearance of the appendix in cases of so-called hemorrhagic appendicitis is well known. In such cases, all that can be seen macroscopically in the submucosa of the appendix is a hemorrhage of some kind. The French hold that appendicitis is merely a local manifestation of a general disease. There may be ulcerations, various sorts of ecchymoses, and erosions in other parts of the intestinal tract that pass unnoticed, and hemorrhage may come from some of these. The view mentioned by Dr Mitchell as supported by Dr Rodman, which regards sepsis and toxæmia as the cause of these lesions, is that on which modern ideas of pathology are based. This view was elaborated by Gandy, one of Dieulafoy's pupils, who (in his Paris theses, 1899) showed that in all gastro-intestinal ulcerations there is some form of toxæmia, and that in all forms of toxæmia there is gastro-intestinal ulceration

Gandy traced in different diseases the various stages of the ulceration up to the well-formed ulcer, in which there may be either hemorrhage or perforation. Dr Ashhurst therefore believes that it is the theory of sepsis and toxæmia upon which the pathology of this complication must be based. He has recently read in the *Lancet* an article by Hort, in which the claim is made that gastric ulcers and similar lesions are due to hæmorrhagins and mucolysins. The writer also claims to have been able to produce these lesions experimentally in some of the lower animals, and to have cured them with antivaccines and serums, both in the lower animals and in patients. This shows that toxæmia must be the cause of these lesions.

DR JOPSON said that while Dr Ashhurst's explanation of the theories as to the cause of hemorrhage after appendectomy would be plausible in cases of acute infection, they would scarcely explain cases that come on after interval-operations and within such a short time that sepsis would not have a chance to be an active feature. If one operates between attacks and the patient has hemorrhage from the bowel eight or ten hours after the operation, one is inclined to ascribe it to the operative technic. While Dr Jopson agreed with Dr Ashhurst that perhaps the majority of these cases are not due to hemorrhage from the seat of the appendix, he thought that a certain number must be. Studies in anatomy have shown the occasional presence of an abnormal vessel at the base of the appendix which might easily escape a purse-string ligature, unless most carefully applied. Although Dr Jopson has continued to use this method of ligation with inversion of the crushed stump, he has been careful to pass the ligature under the site of such a potential vessel at the base of the meso-appendix, so that it could hardly escape the grasp of the suture. This he considers a point of great importance. If active hemorrhage is present, after one cuts the crushed appendix, one should throw a ligature about it. The ideal method is complete excision and the application of the through and through hæmostatic suture, such as is used in gastro-enterostomy, followed by another continuous Lembert suture. One could not, however, venture to recommend this procedure to a large class of surgeons who are doing satisfactory operations by other methods. Nevertheless, it is the ideal method, anatomically speaking.

Dr Davis asked whether the appendix had been crushed first and then inverted with a single purse-string suture, and remarked that a blood-vessel might enter the appendix between the loops of the purse-string suture and so escape constriction. If no circular ligature were applied, part of the circumference would be without pressure. For this reason, in cases in which no circular ligature was applied, the technic might have had something to do with the production of hemorrhage.

GASTRO-INTESTINAL HEMORRHAGE FOLLOWING RADICAL OPERATION FOR HERNIA

DR W E LEE, reported the case of a white male, who was referred to the Pennsylvania Hospital for radical treatment of two inguinal herniæ. As railway engineer, miner and prospector he had been accustomed for many years to severe physical work. During an illness of several months in his seventeenth year he had general anasarca but there was nothing else in his history which had any relation to his present hernial condition.

The examination showed an unusually well developed and well nourished man with heart, lungs and urine negative.

The right hernia appeared twenty years ago and had since been imperfectly supported with a truss. Seven years ago iodine injection treatment had been tried with negative results. At the time of admission there was an easily reducible scrotal mass about the size of a lemon.

The left hernia, which was of six years' duration and had been supported in a similar way with a truss, could just be felt at the left external ring.

Under ethyl chloride and ether anæsthesia the hernial sacks were ligated at the internal rings and excised, then the inguinal canals were reconstructed after Bassini's method.

During the following twenty-four hours he developed abdominal pain and slight distention, which were not relieved by free purgation, and toward evening he began vomiting a clear colorless fluid. The vomiting continued and the distention increased during the following day and fifty-four hours after operation he suddenly vomited 350 c.c. of dark fluid blood, after which the vomiting ceased. Twelve hours later and following a high alum enema he passed from the bowel 500 c.c. of blood very similar in appearance to that which had been vomited. There

was no more evidence of blood in the stools and his recovery was uneventful

It seems safe to assume that this hemorrhage was in no way the direct result of any operative procedure for there was no handling of any part of the gastro-intestinal tract. Numerous similar cases of postoperative hemorrhage of obscure origin are on record, and although the majority of them have followed abdominal operations they occur after operations upon all parts of the body. Appearing usually during the first twenty-four hours, they may occur as late as the tenth day.

Various suggestions have been made as to the etiology. The fact that such hemorrhages are reported after operations with cocaine anæsthesia and even without any anæsthetic seems to discredit the anæsthetic being the cause. Trauma of the gastro-intestinal tract from the operative intervention is not to be considered in this case, for, except the gentle replacing of the coils of the small intestine as they appeared at the internal rings during the ligations of the sacks, there was no handling of the gastro-intestinal tract. Thrombosis of the arterial or venous systems with secondary embolism in the walls of the stomach and duodenum is suggested by the finding, post-mortem, of erosions and ulcerations in the organs. These lesions, however, are not constant and have only been found in a small number of the cases.

Sepsis, considered by Rodman to be the cause in a large number of cases, can also be eliminated in this instance, for there was no sign of any infection.

The prognosis seems to be very grave, in 96 cases collected by Busse there was a mortality of 55 per cent, while Purves reports 72.5 per cent.

The treatment is necessarily symptomatic. Morphia to quiet the movements of the gastro-intestinal tracts, gelatin by mouth or subcutaneously to increase the coagulability of the blood, and saline infusion to replace the lost blood have all proved useful.

TRAUMATIC CEREBRAL HEMORRHAGE

DR GWILYM G DAVIS reported the case of a woman, aged 34, who was brought into the Episcopal Hospital in an unconscious condition. It was ascertained that on the day of the

injury she had been on a visit to her sister and had drank freely and later started for home evidently under the influence of liquor. While on her way home she fell and struck her head on the pavement. She was taken to the police station and thence sent to the hospital. On admission her temperature was 99° , pulse 88, respiration 24. Patient was dull, heavy, stupid, almost in coma. She seemed to be sleeping soundly but could with difficulty be aroused. The mouth was open and tongue dry. There was some hemorrhage from the left ear and contusions of the nose, but no other apparent evidences of injury. There was a slight inequality of the pupils, the left being somewhat the larger. No paralysis of the extremities. Pulse full and strong, urine 1020, acid and slight trace of albumin, no sugar. Three days later she could be roused sufficiently to talk a little, but her mind was not clear. She fed herself with the left hand, but moved the right slightly. During the next ten days her mind became clearer and her temperature normal and while much improved in her general condition the partial paralysis of the right arm persisted.

On the 14th day she was not so well and her temperature rose to 99.8° . The next day she was found almost comatose with a temperature of 100° and a full, strong pulse of 60 to the minute. The right pupil was dilated more than the left. She was immediately removed to the operating room and trephined on the left side below and in front of the parietal eminence. The dura bulged into the opening and looked congested, but showed no pulsation. On opening it no evidences of clot were discovered. She was turned on the other side and the trephine applied below and in front of the right parietal eminence. There was no pulsation, but on opening the dura a large clot was found. This was scooped and washed away, leaving the brain apparently normal. The dura was sutured, a wick drain inserted and both wounds closed. On the following day the drain was removed. Her temperature rose to 102° and her pulse to 132. On the 2d day after the operation she could be aroused and understood what was said. Her pulse improved and her temperature began to decline. On the 4th day her mental condition was improving, her temperature was nearly normal and she began to move her right arm. She continued steadily to improve and was discharged six weeks after the operation, cured. Her mind was clear and she had fully recovered the use of the right arm. This case was

not operated on earlier because of the lack of localizing symptoms at the time of her admission and her subsequent steady improvement. Previous to the day of operation the localizing symptoms were bleeding from the left ear on admission, a slightly larger pupil on the left side and two or three days later a partial paralysis of the right arm. These symptoms all pointed to a lesion on the left side of the brain. On the day of operation, however, the right pupil was the larger. In view, however, of the persistent right-sided paralysis and history of bleeding from the left ear it was decided to explore the left side first. The opening was so placed as to allow it to be extended forward if necessary and allowed of the areas of both the anterior and posterior branches of the middle meningeal artery to be reached. The paralysis as well as the absence of pulsation when the skull was opened showed that the left side of the brain was affected, whether it was by the direct concussion from the injury or by transmission of pressure from the right-sided effusion is a question. From the fact, however, of the paralysis not being noted until the 2nd or 3rd day after the injury we believe it to have been secondary and due to transmitted pressure. The fact of the clot being found on the right side shows that the dilated right pupil was a better index of the locality of the lesion than the partial paralysis of the right side. Traumatic cerebral hemorrhages whether epidural or subdural are most likely to occur at the site of impact. If, however, they are not found there then, as shown many years ago by Dr. Formad, they are found on the opposite side. While cerebral hemorrhages (clots) are very commonly the result of contrecoup cerebral fractures are rarely so and even when present are apt to be insignificant in extent. These hemorrhages by contrecoup are most likely to be subdural, although it is probable that in some rare instances they may be epidural or between the dura and the bone.

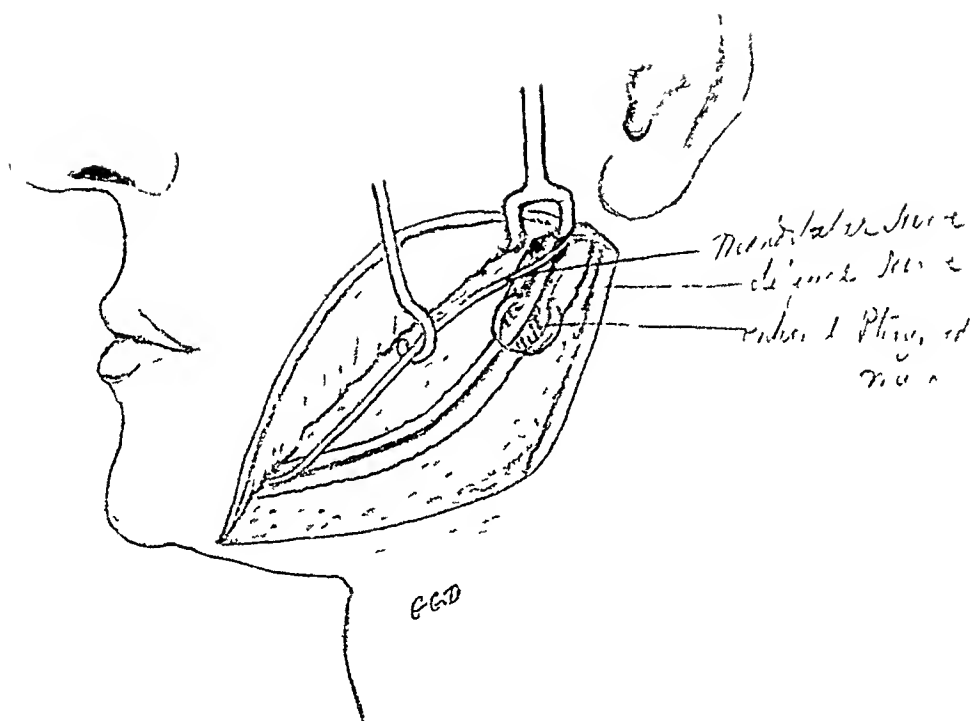
DR A. P. C. ASHHURST said that during the last few weeks he had seen, at the Episcopal Hospital, a case under Dr. Neilson's care, who was struck on the right side of the head during a fight, and was brought to the hospital in a semi-conscious condition. He was treated for fracture of the base of the skull. Dr. Ashhurst did not happen to see him again for several days, when he noticed that he was having twitching convulsions of the right forearm and both lower extremities, but the left arm

was not moving at all. The right pupil was widely dilated, and pressing upon the supra-orbital nerve elicited facial palsy on the left side, very marked. Dr Ashhurst had thought that it was a case of extradural hemorrhage. The patient grew worse and died, and at autopsy a fracture of the skull involving the base and a subdural hemorrhage were found, as in Dr Davis's case. The dilated pupil was on the side of the lesion, the right side, as also in Dr Davis's case.

REMOVAL OF THE LINGUAL AND MANDIBULAR NERVES BY THE TWISTING METHOD OF THIERSCH

DR GWILYM G DAVIS reported the case of a woman, aged 47, who applied for the relief of a neuralgia affecting the tongue and lower jaw. The pains had begun five years previously, they were intermittent and affected chiefly the left side of the tongue and cheek down to the angle of the jaw. The paroxysms became frequent and severe, coming on most often in the morning when arising from bed. Sometimes, though rarely, she would have attacks at night. The pupils reacted normally and the tongue when protruded would deviate slightly to the right and was tremulous. She was otherwise well. The following operation was performed. An incision was made beginning about a centimetre below the ear and carried down behind the ramus and angle of the jaw and forward along the under side of its edge to just forward of the anterior edge of the masseter muscle. With a periosteal elevator the soft parts were detached from the bone and turned upward. The jaw was cleared off upward until the coronoid notch (*incisura mandibulæ*) was reached. A half inch trephine was then placed midway between the notch above and the lower edge of the jaw below and a button comprising the outer layer of compact tissue removed. The bridge of bone between the trephine opening and notch above was removed and the canal opened by means of a chisel downward until near the mental foramen. The mandibular nerve being thus exposed was lifted from its bed and displaced upward (Fig 1). The bleeding from the accompanying artery was controlled either by ligation or packing. The trephine was then again introduced and another button of bone comprising the inner side was removed. With a forceps a considerable amount of fat was taken out and the lingual nerve exposed lying almost directly beneath on the internal

FIG 1



Operation for the removal of the lingual and mandibular nerves, by torsion

pterygoid muscle With a curved, long jawed, hæmostatic forceps introduced through the trephine opening both nerves were grasped, being lifted by a blunt hook until they were well up from the end of the forceps The forceps were then slowly turned, not faster than one turn in a half minute or more It took 13 minutes to complete the removal of the nerves

The wound was packed with gauze and closed with sutures The gauze was removed on the second day and the stitches on the fourth and the wound closed by primary healing This mode of removing peripheral nerves by torsion very slowly applied was devised by Thiersch (*Verhand der Deutschen Gesellschaft für Chirurgie*, 18th Congress, Berlin, 1889, p 44)

Angerer (*Archiv für klinische Chirurgie*, Bd 53, s 179) gave the results in 26 cases, of these 2 changed to some other branch, 7 returned and 17 remained free, 16 had been operated on for more than 4 years Of these three were reoperated on and one died of intercurrent disease Of the remaining 12, three had a return of the pain and seven remained free

Dr Davis further remarked that these results are so much better than those in which only small portions of the nerve are removed as to demonstrate its superiority and necessitate the abandonment of the latter The Thiersch method can be successfully employed for the supra- and infra-orbital, the mandibular (inferior dental) and lingual nerves It seemed to him to be decidedly preferable to the operations devised by Kocher, Horstley, Lucke, Pancoast, Minter, Carnochan, and many others The lingual nerve if alone involved can be readily removed by the Thiersch method through an intrabuccal incision, but to attempt the removal of the mandibular (inferior dental) nerve through the mouth by the method of Paravicini is a delusion and a snare

The disfigurement arising from an incision along the posterior and inferior edges of the jaw will be but slight if the subcutaneous tissues are first brought together with catgut sutures and then the skin united with the subcutaneous suture or very fine interrupted sutures removed by the 4th or 5th day In the case reported the bone between the trephine opening and incisura above was removed in order that the mandibular nerve could be raised up out of the way in order to complete the section of the bone and allow access to the lingual nerve below

The length of the lingual nerve removed was 15 cm (6 in)

and that of the mandibular 12.5 cm (5 in) (Fig 2) Had the bone been removed and the dental canal opened clear down to the mental foramen as should have been done then more of the latter nerve could have been removed The commencement of the incision from below the ear to the angle of the jaw is to be carried only through the skin and subcutaneous tissue, the parotid gland lies beneath and it should not be incised but dragged upward out of the way There is a great tendency for the nerves to slip off the end of the forceps To avoid this Dr La Place suggested the use of a slender pair of long jawed curved hæmostatic forceps Their use was found to be perfectly satisfactory in this case

The area of anæsthesia produced by the operation embraced the left half of the tongue and the floor and outer wall of the mouth The roof of the mouth, palate and upper alveolus were sensitive Taste was lost on the left half of the tongue until its base was reached just in front of the circumvallate papillæ On the outside of the face sensation was lost anteriorly in a line starting at the upper anterior edge of the pinna and passing downward and forward to the angle of the jaw, posteriorly the line extended from beneath the lobe of the ear, along the line of incision, to the middle of the chin The patient is still free over a year since the operation

Pathological Report—A microscopical examination of the excised nerves by Dr Geo P Muller revealed nothing except a slight proliferation of the neurilemma

DR MORRIS BOOTH MILLER recalled an experience that he had had about a year ago In this case, Dr Miller attempted to do an inferior dental nerve avulsion and at the same time he wished to avoid the disfiguring scar on the outside of the face The method followed was first used by Paravicini, who suggested that the inferior dental nerve might be attacked through the mouth Dr Miller had a good deal of difficulty in performing the operation The idea of avoiding any scar appealed to him, and he finally succeeded, but he had great trouble in reaching the nerve He had thought that the spine of Spix and the internal lateral ligament would be landmarks more easily reached and identified than it proved He caught a nerve and, after having pulled on it with a certain amount of force, he found that the tongue twisted with the twisting of the nerve He therefore recognized that he had the lingual nerve, which was not involved

FIG 2.



A Lingual nerve B Mandibular nerve (Natural size)

Fortunately, he had discovered his mistake in time to avoid damage. After a good deal of difficulty, he succeeded in getting out the proper nerve, but he would never undertake this method again. He considers the operation used by Dr. Davis the only correct one in reaching the inferior dental nerve, but the lingual can be reached more easily by the intrabuccal route. In working through the mouth, however, it is hard to get light and there is not much room for the finger or instruments.

DR. JOSEPH M. SPELLISSY asked Dr. Miller whether there had been any return of the neuralgia in the case in which he had operated through the mouth.

DR. MILLER replied that the neuralgia partially returned some time after the operation.

DR. GEORGE P. MULLER said that he had done a number of these operations always removing the inferior dental nerve through an incision made along the angle of the lower jaw without having much of a scar, if the wound was closed by a subcuticular stitch. In two cases the incision divided the lower lobules of the parotid gland, and in one of these some trouble was experienced afterwards in closing a small salivary fistula. On one occasion he had removed almost as much of the nerve as in the specimen shown by Dr. Davis by trephining the angle and dividing the inferior dental nerve in the usual manner, and then, by means of a second incision, pulling it out of the jaw through the mental foramen and then twisting in the usual manner. The greatest difficulty he has encountered in these operations is to keep the nerve on the hæmostat while twisting. He uses a blunt hook to hold the nerve, keeping one hand on the hook, and the other twisting on the hæmostat. After having twisted the nerve three or four times and thereby loosening it, he allows it to untwist again and takes a more secure grasp with the hæmostat. The turns should be made very slowly.

DR. DAVIS, closing, said that the operation is such a radical one so far as the amount of nerve that is removed is concerned and the fact that at least seven of the fourteen cases remained permanently cured makes it the procedure of choice when a peripheral operation is decided upon.

Regarding Dr. Miller's remarks in reference to the intrabuccal procedure, Dr. Davis said that the operation was that of Paravicini and was described in Bryant's "Operative Surgery."

The lingual nerve is very readily reached beneath the mucous membrane immediately behind the last molar tooth, where it crosses obliquely toward the tongue, but to reach the inferior dental by the intrabuccal method, however, is quite another question. It is very deep and close to the inner side of the jaw. Going upward and inward from the angle of the jaw, one meets the internal pterygoid muscle. Between this muscle and the jaw there is a cleft in which the nerve and the artery are found, the muscle also is attached to the jaw with the spinamandibular ligament above it. The spine of Spix may not be perceptible to the sense of touch, for the finger will run along the jaw and over the spine to the ligament, which is in front of the nerve and the vessel. To reach these, one must get rid of the ligament. If it is cut, one is liable to cut the nerve, because it is so close. If you hook it forward and cut it, you can reach the nerve and artery, but the inferior dental artery will probably be cut, and as it is a good-sized artery its bleeding will obscure things. If, however, it does not bleed, and you proceed to take out the nerve, the distance between the lower part of the skull and the jaw is so slight that it would be difficult to remove the nerve thoroughly, on account of the difficulty in manipulation.

Dr. Davis does not believe in any of the operations on cranial nerves that require one to work through too small an opening, because too little of the nerve is removed, for instance, the operation on the inferior dental through the mouth, or the operations through the zygomatic fossa in the temporal region on the maxillary and mandibular branches of the fifth nerve.

TO CONTRIBUTORS AND SUBSCRIBERS

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 386 Grand Ave., Brooklyn, N. Y.

Remittance for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS OF SURGERY,
227-231 South Sixth Street,
Philadelphia

ANNALS OF SURGERY

VOL. XLVIII

NOVEMBER, 1908

No 5

ORIGINAL MEMOIRS.

THE USE OF ETHYL CHLORIDE AS A GENERAL ANÆSTHETIC IN THE PENNSYLVANIA HOSPITAL.*

BY W. ESTELL LEE, M.D.,

Chief Resident Physician of the Pennsylvania Hospital

DR CHARLES F MITCHELL, in the winter of 1902, first used ethyl chloride for general anæsthesia in the receiving ward of the Pennsylvania Hospital, and it proved so satisfactory for short light anæsthesias that it was introduced into the general surgical wards and there used for minor operations and painful surgical dressings Dr Francis O Allen, when Resident Anæsthetist, first used it in combination with ether and chloroform during the early part of 1903

There are now records of its use in 5575 cases during the period commencing December, 1902, and ending June 1, 1908, as follows Alone, in 947, with anesthol, in 47, with anesthol and ether, in 391, with ether, in 4148, with scopalamine and morphia, in 1, with chloroform, in 2, and with intraspinal injections of stovaine, in 39

The youngest patient was 24 hours old and the oldest 84 years The lengths of the anæsthesias have varied from several seconds to 54 minutes The average dosage for 3 minutes has been 10 grammes

* A preliminary report read before the Philadelphia Academy of Surgery, June, 1908

Bengue's preparation of ethyl chloride was first used, but it was soon found that an American product known commercially as antidolorin was just as satisfactory and the latter has been used in practically all of the cases

Several of the many forms of closed and semiclosed inhalers devised for its administration have been tried and abandoned for gauze. If a prolonged anæsthesia is desired or the ethyl chloride is to be followed by another anæsthetic, the patient should have the usual anæsthetic preparation, otherwise, it may be given without this preparation. Lying in the supine position the patient is told to breathe quietly, close the eyes and prepare for sleep. Upon several layers of wide mesh gauze, held from 6 to 8 inches from the face, the anæsthetic is slowly dropped. As the patient becomes drowsy the dose is increased and the gauze brought closer to the face and with the loss of consciousness, the gauze, 4 to 8 layers thick, is placed over the mouth and nose and the ethyl chloride given with the spray. Sometime before the loss of consciousness the patient is anæsthetic to very severe pain and many minor operations requiring but a few minutes may be done in this stage. Frequently in this stage there is a respiratory arrest, especially if the anæsthetic has been given too rapidly or too concentrated, but with its continued administration the respirations are resumed becoming slower and deeper. With the progress of the anæsthesia the eyeballs begin to roll and the pupils partially dilate when the patient enters the second stage, in which there is deep anæsthesia without, however, much muscular relaxation and with, frequently, considerable muscular rigidity and spasm. Progressing still further the eyeballs become fixed, the pupil widely dilated and immobile, the corneal reflex disappears and the face is flushed and covered with perspiration. This is undoubtedly the danger-line beyond which the respirations become insidiously shallower with consequent deepening cyanosis, there may be an external squint of the eyeballs and frequently muscular rigidity and spasm or as rarely occurs general relaxation. The fatalities seem to be due primarily to respiratory and secondarily to cardiac failure

Large and Brown, in their experiments on dogs, seem to have confirmed the clinical observations that there is always a fall of blood-pressure, which in a few cases may be preceded by a temporary rise, and their explanation of the respiratory failure is that it is due to a paralysis of the respiratory centre produced possibly by the lowered blood-pressure

When ether is to follow the ethyl chloride it is gradually introduced drop by drop upon the same gauze at the period when the patient loses consciousness and while its dosage is rapidly increased, the ethyl chloride is gradually withdrawn. If, however, a sudden change is made from the ethyl chloride to the ether, the patient will in the majority of cases recover from the ethyl chloride intoxication before that of the ether appears. It is the feeling in the hospital that with this slow induction requiring from 2 to 3 minutes, the gradually increasing dosage and the free admission of air allows a more careful observation of the progress of the anæsthesia and a timely recognition of the danger-line, and when one remembers that with large concentrated doses and a closed inhaler a patient can be carried beyond this line in from 8 to 20 seconds this will be understood, also with this method we do not have the frequent occurrence of muscular spasm, post-anæsthetic vomiting and headache so strongly emphasized by those using the closed method.

Safety is undoubtedly the first consideration in the use of any anæsthetic and though ethyl chloride has been used since 1847 and very generally used in England and on the continent since 1897 there is still a great difference of opinion as to its mortality. Hewitt places it between ether and chloroform with an estimated mortality of 1-10,000 and in the latest edition of his book quotes McCardie's figures of 1-3000. Luke makes one estimate of 1-8000 and a few months later 1-150,000. Each of these men have had personal experience in over 2000 cases without any fatalities. Herrenknecht reports 3000 cases without a mishap.

Such varied difference of opinion, Hawley suggests, would indicate that there may be other elements present, indepen-

dent of the anæsthetic itself, to cause death, and a careful analysis of the reported fatalities seems to support this suggestion. There are recorded in literature in a rather imperfect way some 21 cases which have been collected by Luke, and to these we now add 4 more. Another fatal case reported by Dr Allen is case No 3 in this list.

In view of Hawley's suggestion an analysis of these cases is very interesting.

Case 2 was a 12-months-old child with diphtheritic laryngeal obstruction.

Case 5 was a large healthy man 24 years of age with a huge submaxillary abscess. Several minutes after the removal of the anæsthetic and after the abscess had been opened, respirations stopped so suddenly as to suggest that there was some acute laryngeal obstruction. At least four minutes later a tracheotomy was done without the reestablishment of respiration. The autopsy showed marked œdema of the glottis with a relaxed fold of the mucous membrane over the abscess wall "which might have been" sucked into the small air-passage of the glottis.

Case 6, a male 67 years old, whose autopsy showed a very large mass of malignant cervical glands encroaching upon the lumen of the pharynx and larynx and involving the vocal cords.

Case 3, reported by Dr Allen in 1903, was a colored man 28 years of age with an incarcerated hernia. He had been vomiting freely but the vomitus was not fecal in character, otherwise his condition was good. During the change from ethyl chloride to ether he suddenly recommenced vomiting and brought up large quantities of a clear fluid. This lasted three to four minutes, after which respirations were not resumed. An examination by the surgeon failed to show any pharyngeal or laryngeal obstruction and he considered it an anæsthetic death. There was no autopsy.

Case 22—Ethyl chloride was chosen as the anæsthetic for a negro 17 years of age, with an acute ischio rectal abscess, because of a harassing cough, profuse expectoration and signs of a chronic consolidation of the left lung. He was placed in the lithotomy position, and though never deeply anæsthetized, received considerably more than the usual ten grammes for the anæsthesia.

extended over a period of more than 15 minutes. Ten or fifteen minutes after the withdrawal of the anæsthetic there was a violent paroxysm of coughing, after which the respirations ceased and were not reestablished with vigorous stimulation, artificial respiration and tracheotomy. The pulse in this case continued beating for some time after the respiratory arrest. At the post-mortem examination the whole left lung was found to be involved in a tuberculous consolidation with a small cavity in the apex, there was a tuberculous pericarditis with a large amount of fluid in the sac and a tuberculous peritonitis.

Case 23 —A negro 30 years old, while attempting a highway robbery one week previous to his admission to the hospital, received a load of buckshot in the lower part of the left axilla. He had remained in hiding all this time without medical attention and when he entered the hospital there was a large gaping wound in the lower portion of the left axilla and the physical signs of a general peritonitis and profound sepsis. While being placed upon the operating table his pulse became imperceptible and after receiving less than a gramme of ethyl chloride given in the usual way and before any operative procedure could be commenced his respirations gradually ceased. The autopsy showed a large wound of the left pleura and an empyema of the same pleural cavity, a wound and empyema of the pericardial cavity, a wound of the diaphragm, perforations of the stomach and intestines and a purulent peritonitis.

Case 24 —D H, an unmarried negress, 30 years of age, was being treated in the medical wards for *Adiposa Dolorosa* and developed a *Ludwig's Angina*, associated with marked laryngeal obstruction. Incisions beneath the jaw opened the sublingual tissues and allowed a few drops of pus to escape. When the patient was placed in the dorsal position the laryngeal obstruction was considerably increased and after receiving about 5 grammes of ethyl chloride given in the usual way her respirations stopped, the pulse remaining unaffected, but with the removal of the anæsthetic and artificial respiration they were quickly resumed. Twenty-four hours later, the œdema and the laryngeal obstruction having increased, another operation was attempted and as before the respiratory obstruction was greatly increased by the dorsal position and after receiving about a gramme of ethyl chloride it became complete and was never reestablished,

though a quick tracheotomy was done The autopsy showed acute inflammation and cedema of the pharyngeal, sublingual and cervical tissues with cedema of the glottis

Case 25 —A young married negress with the diagnosis of tubo-ovarian abscess was given an unknown quantity of ethyl chloride preliminary to a proposed ether anæsthesia After taking the anæsthetic for one or two minutes the respirations suddenly ceased and though the pulse could be felt for a short time after the respirations had stopped it soon disappeared and cardiac stimulants together with artificial respirations produced no effect There was no postmortem examination and a physical examination made just before the anæsthetic was given was negative except for the presence of a loud systolic heart murmur without any signs of lost compensation

Seven of these fatalities recorded in the literature occurred during dental operations and the anæsthetic was given by the dentist or his assistant In eight cases the patients were in the upright position when the ethyl chloride was administered In seven cases where the method is recorded a closed or semi-closed inhaler was used 3-6 c c of the ethyl chloride being sprayed at once into the bag and given to the patient

The occurrence of several deaths under anæsthesia at Guy's Hospital is the cause for an editorial in the *Hospital*, London, in which anæsthetic deaths are carefully considered During the period of 6 years from 1901 to 1907 there occurred at Guy's 36 deaths under anæsthesia, in another hospital 31 in 85,000 anæsthesias, and in still another 7 in three years And it raises the question of whether it is right to credit all of the operative deaths which occur under anæsthesia to the anæsthetic when the surgeon wishing to give the patients every possible chance will operate upon them when almost moribund It also criticizes the compiling of statistics from various hospitals and thus estimating mortalities

With these criticisms in mind we have reviewed the records of all the anæsthesias given in the hospital during this same period of five and a half years They were administered by

the Resident Anæsthetizers and Resident Physicians. Squibb's ether was used in practically all of these cases. In a very few, during the early part of the period, the anæsthetics were given with an Allis inhaler, in all of the remaining ones the gauze and drop method was employed.

There have been 5575 cases in which ethyl chloride has been used as a general anæsthetic and during the administration of which 5 cases died. The ethyl chloride was used alone in 947 times and all of these deaths occurred while it was being used in this way and none when used in combination with other anæsthetics, ether, chloroform, or anesthol, of which there were 4628. The fact that the ethyl chloride was given first and to all the cases which were considered bad anæsthetic risks distorts these statistics:

Ether was given 5592 times and during its administration 3 deaths occurred. As with the ethyl chloride all of these deaths occurred while it was being used alone in 1444 cases, one as the operation was begun, the other two near their completion.

An agent which may in 15-20 seconds produce deep anæsthesia and whose danger-signs are so easily passed cannot be used with impunity, and a few of the reported fatalities certainly demonstrate its danger in inexperienced hands. Another objection to its use is the muscular spasm and rigidity which occurs especially in alcoholics and very frequently in others. This, however, may be overcome more or less by the preliminary use of morphia and atropine and by following the ethyl chloride with ether.

Its advantages, on the other hand, are very tempting. For the patient there is no irritation of the respiratory tract with its usual coughing, increased secretions, gagging and vomiting, and therefore no respiratory struggle so often seen in ether and chloroform anæsthesia. The rapid onset of unconsciousness is not to be overlooked and its advantage will be appreciated by any who have taken ether patiently for 6 to 10 minutes. And most important the usual amount of ether necessary for the induction of anæsthesia to the third stage is

eliminated and as this averages four ounces with the open drop method the excretory organs are saved a considerable task. In our experience it certainly lessens the occurrence of post-operative vomiting.

To the anæsthetist the ease and rapidity of induction with complete elimination of the preliminary stages of ether and chloroform speaks for itself.

Though the mortality with ethyl chloride in this series of cases, is apparently greater than that of ether it is still being used in the hospital for (*a*) minor surgical procedures where a short anæsthesia of a few seconds to five minutes is desired, (*b*) the dressing of the more painful surgical wounds, such as the removal of abdominal packs, (*c*) and in combination with ether and chloroform.

LUDWIG'S ANGINA.

REPORT OF FIVE CASES INCLUDING ONE AUTOPSY *

BY JOHN W. PRICE, JR., M.D.,

OF LOUISVILLE, KENTUCKY

IN the year of 1836, Dr Ludwig of Stuttgart, described an acute septic inflammation of the submaxillary region, accompanied by a hard sublingual swelling, together with the symptomatology. This condition has been designated Ludwig's angina. Dr Thomas has recently collected 106 cases in the literature including two of his own with a mortality of 40.3 per cent. I take this opportunity to express my indebtedness to this comprehensive article by Dr Thomas for many of the references in my own paper. Probably many cases have occurred which have not been recorded. That it sometimes occurs in groups has been observed by F Murchison, Klein, Seymour-Taylor and G G Davis. The latter says that five of his cases came from the same section of the city in a period of five weeks.

The five cases which I am reporting were admitted to the Episcopal Hospital, Philadelphia, between March 1 and May 12 of this year. Although two of them developed in the same ward of the hospital, I do not regard the condition contagious.

1 *The Infecting Organism*—No specific organism has been found for Ludwig's angina. Dr Thomas searched the literature and found eighteen cases reporting the bacteriological findings as follows:

The streptococcus was found alone in six cases. The streptococcus associated with other organisms, staphylococcus and diplococci in eight, the staphylococcus alone in two, the pneumococcus alone in one and an undetermined bacillus in one.

* Read before the Philadelphia Academy of Surgery, June 1, 1908.

In my cases the following organisms were found

CASE I—Cultures and smears show mixed bacteria flora

CASE II—Cultures and smears show mixed bacteria flora—Staphylococcus, micrococcus salivarius—Biondi, Streptococcus capelletti

CASE III—Micrococcus salivarius—Biondi

CASE IV—Micrococcus salivarius—Biondi

CASE V—Cultures from incision show Bact ferrugineum (Dyal), by aspiration, large diplococcus, small diplococcus, long, thin bacillus, streptobacillus (strepto-diplo-bacillus?)

2 *The Primary Focus of Infection*—The most common primary focus of infection is dental caries Dr Davis reported one case in which the inflammation was started by a dentist injecting a solution of cocaine around a carious tooth and extracting it Two of the cases now reported started in this manner After cocaine had been injected in the gums and the tooth extracted, Case IV developed a submaxillary swelling in 48 hours and Case V developed a submaxillary swelling in 24 hours Case III had carious teeth and a submaxillary swelling of a month's standing but a sudden enlargement of this swelling developed in four to eight hours after a dentist had pulled a tooth Other foci that have been mentioned are wounds of the mucous membrane, otitis media, peritonsillar abscess C J Aldrich reports a case that started from the tonsil and W A Humphrey describes a case preceded by tonsillitis

One of the present patients (Case I) had an attack of tonsillitis with a temperature 103 which gradually subsided to normal in five days, but six days later the patient developed Ludwig's angina Case II complained of sore throat and examination showed redness of the pharynx, the next day the patient had developed Ludwig's angina and in 55 hours he was dead

3 *The Mode of Transmission of the Infection*—If the primary focus is in the tooth as in Case III, IV and V, I agree with Dr Davis that the inflammation involves the periosteum of the lower jaw and thence invades all the surrounding tissues

by direct contiguity. But if the primary focus is the pharynx (Case II) or the tonsil (Case I) or some other point distant from the submaxillary region, it is probable that the infection was carried by the lymphatics. It is possible there is transmission of the infection from the mouth by the ducts of the sublingual gland which show marked inflammatory cellulitis in the sections from Case II.

Regardless of the seat of the primary focus, the secondary infection in these cases is in the submaxillary region, the floor of the mouth, and the following muscles: digastric, stylohyoid, mylohyoid, geniohyoid, geniohyoglossus, hyoglossus, chondroglossus, styloglossus, palatoglossus, sternohyoid, sternothyroid, thyrohyoid, omohyoid.

The connecting tissues and overlying subcutaneous tissue are also affected. The pharynx and larynx become rapidly involved. In a fatal case, as in Case II, the entire trachea may be invaded. The cellular infiltration travels by the lymphatic spaces and by contiguity.

The clinical picture of the condition given by Ludwig was that of a fatal case.

The following are the symptoms of the early and less severe types:

Constitutional—There is early fever, temperature 99 to 103, headache, malaise, loss of appetite and insomnia.

Local—Increase in the secretion of saliva which is of a thick ropy character. If there is an opening into the mouth there is a profuse mucopurulent discharge together with the saliva which may amount to as much as sixteen ounces in twenty-four hours. Soon the patient notices a submaxillary swelling of a shoe-leather resistance which is painful. There is also tenderness which may be marked or slight. Then there is rapid oedema of the sublingual tissues and swelling of the face as far up as the malar bone and swelling of the neck down to the clavicle. The larynx and pharynx are rapidly affected and there is difficulty in opening the mouth, in swallowing, talking and breathing.

Treatment—As soon as the diagnosis is made, use local

anæsthesia (ethyl chloride) and make incisions over the sub-maxillary triangles through the mylohyoid muscles and if there is severe swelling also through the median line between the hyoid bone and the symphysis to the mucous membrane. Use rubber drainage-tubes through and through the lateral incisions.

If the sublingual tissue is markedly œdematous, incise the mucous membrane from the midline to the second molar tooth and then insert a curette and curette wherever there is a feeling of the tissues giving way. There is usually a profuse discharge of blood which clots immediately. There will then be a profuse mucopurulent discharge of a very foul odor and bad taste. The relief is instant. You can actually see the sublingual œdema subside, and the patient will tell you that he can talk better and you will be able to notice the change in the voice.

Prognosis—Dr G G Davis reports mortality 40 per cent in the cases under his own care. Thomas in his recent paper gives the mortality as 40.3 per cent for all the cases reported.

Of the five cases now reported, one died and four recovered—mortality 20 per cent. The first of these patients was admitted to the Episcopal Hospital in the service of Dr William T Van Pelt and the other four in the service of Dr Thomas R Neilson with whose kind permission they are presented.

CASE I—(Surgeon, Dr William T Van Pelt) J T, age 29 years. Admitted December 24, 1907, suffering from interstitial keratitis. February 13, 1908, complained of sore throat, headache, backache and loss of appetite. 5.30 P M. Examination: throat, pharynx and tonsils are red. 11.50 P M, tonsils are slightly swollen and show a few follicles filled with pus. Treatment: H_2O_2 and $AgNO_3$ gr 1x to 5i.

2-20-'08 Less pain in the throat. Tonsils are swollen and some crypts contain pus. Anterior cervical glands are enlarged.

2-23-'08 Very few crypts contain pus. Has no pain. Feels well. Temperature 98°.

2-29-'08, 9 A M Has complained all night of not sleeping and of pain in the throat Difficulty in swallowing Examinations show tonsils red and anterior cervical glands are enlarged and painful

3-1-'08, 12 15 A M Complains of pain and swelling of floor of mouth and difficulty in talking and drinking Cannot take food Examination shows marked cellulitis of neck and the submaxillary region is very painful and tender to touch Very hard Difficulty in moving tongue and opening mouth Marked œdema of floor of mouth and mucous membrane. Tongue is swollen Increased saliva Condition resembles Ludwig's angina

Operation by Dr Price —Local anæsthesia—ethyl chloride Three incisions are made One in the median line below the chin and two lateral incisions into the submaxillary triangle Blood and serum flowed freely Subcutaneous tissue œdematous A rubber drainage-tube is passed through and through the lateral incisions Patient says he feels much better

3-1-'08 P.M Patient is doing nicely Not so much submaxillary swelling

3-2-'08 (1st day after operation) Dr Davis examined patient and considered it Ludwig's angina Dr Davis passed a knife by median incision, through the floor of the mouth Incisions are draining blood and serum Patient feels better He can get his mouth open more easily. Tongue is only slightly swollen

3-3-'08 (2nd day) General condition is very much better. Not so much swelling Patient is expectorating a foul, bloody mucopurulent sputum The pharynx is not so congested Incisions are draining bloody serum—no pus *Tube removed* Iodoform gauze inserted

3-4-'08 (3rd day) Says he feels quite well Tongue is normal The lymphatics are markedly improved, only slightly enlarged Feels like eating Incisions are draining very little

3-5-'08 (4th day) Doing splendidly All symptoms have subsided Temperature normal, 98 2°. The cornea is also much clearer than it has been

3-15-'08 The incisions are granulating Cultures and smears showed mixed bacteria flora

4-8-'08 Discharged The cornea is still cloudy and conjunctiva is slightly congested Has no pain Vision is fair

CASE II—(Surgeon, Dr Neilson) W T, age 80 years
Diagnosis On admission, leg ulcer Revised, complications, œdema of larynx, nephritis, myocarditis, arteriosclerosis, submaxillary adenitis, Ludwig's angina Result Died

December 30, 1907 Patient was admitted to hospital for leg ulcer, size of silver dollar

April 4, 1908 Complained of sore throat Examinations showed redness of pharynx, especially on left side Teeth are mostly missing, but there are several stumps or snags in bad condition

On the next day there was difficulty in speaking Examination showed œdema of sublingual tissue and slight cellulitis of submental region and submaxillary regions, especially the left

Operation by Dr Price Multiple incisions made in mucous membrane beneath the sides of the tongue Local condition not relieved

By the following day, 8 P M, sublingual œdema increased and patient does not talk so well Has difficulty in breathing and swallowing and does not take food An incision is made in the mucous membrane for one inch parallel to the alveolar margin along the base of the tongue on both sides An incision is made in the median line into the sublingual tissue These incisions seemed to relieve the patient at once of some of the œdema He said he felt better and could talk more distinctly

4-7-'08 (2nd day) Patient died at 6 45 A M It is said by the nurse that just before death he was talking to a patient in the next bed and that suddenly he fell over dead

AUTOPSY

Tongue—Tissues of the mouth beneath the tongue seem to be swollen and œdematous, posterior part of the tongue is slightly swollen Both tonsils are greatly enlarged, swollen, and on section in places show oozing of a small amount of thick creamy pus

Pharynx—Epiglottis greatly swollen and congested, reaching in places nearly half an inch in thickness The larynx in the region of the vocal cords is greatly swollen and congested and œdematous, showing acute inflammatory œdema The left side of the epiglottis and the larynx seem swollen more than the right

Cultures were made from the larynx, from the tissues in the immediate vicinity of the larynx, and from the base of the tongue

Smears from these regions were also made. The streptococcus capelletti and the micrococcus salivarius—Biondi were found.

Trachea—Showed marked swelling of the mucous membrane covered with a fibrinous mucopurulent exudate throughout.

MICROSCOPICAL SECTIONS

1 *Tonsil*—Shows marked congestion, vessels are markedly dilated and filled with blood, the crypts are filled with plugs of granular debris containing bacteria. The peritonsillar tissue shows marked congestion and marked œdema and the perivascular spaces show large collections of leucocytes.

2 *Epiglottis*—Section shows epithelial surfaces everywhere covered with much mucus, epithelial cells and leucocytes. Below epithelium the tissue is everywhere infiltrated with leucocytes, red corpuscles and inflammatory œdema. In some areas these collections of leucocytes, especially around the vessels, form distinct round abscesses. The vessels are everywhere markedly congested. This inflammatory œdema and exudation extends down to the cartilage.

Base of Tongue and Sublingual Gland—The sublingual gland shows marked inflammatory cellulitis. The stroma is markedly infiltrated with leucocytes. These cellular infiltrations are so great that they press on the glandular tissue in many places to such an extent that the normal shape is lost. The tissues surrounding the gland contain considerable fat markedly infiltrated with large areas of leucocytic collections. These collections of leucocytes are so great that they form small pockets of pus.

The inflammatory infiltrations *i. e.*, the leucocytic collections continue to the underlying muscular tissue and infiltrate the muscle fibres, separating them from one another. The intermuscular tissue in this area also shows considerable œdema and in some places there are to be seen small hemorrhages. All of the blood-vessels are congested.

Base of Tongue and Submaxillary Gland—The submaxillary gland is apparently normal. The borders show slight inflammatory œdema and collections of leucocytes. The remainder of the section shows a similar condition described in section 3, *i. e.*, inflammatory exudate, œdema, hemorrhages and pus. Sections 5 and 6 also taken from the base of the tongue at different points show the same conditions. These six sections have also been stained to show the presence of bacteria. In the infiltrated areas there are moderately large micrococcus, a small diplococcus, a small diplococcus in chains. The study of sections with the microscope seems to show that the cellular infiltration has travelled by the lymphatic spaces and by contiguity.

Diagnosis—Acute œdema of larynx secondary to a phlegmonous condition of the soft parts surrounding, marked interstitial nephritis, marked myocarditis with calcification of the larger vessels and sclerosis of the mitral and aortic valves and coronary vessels, old tuberculosis of the apices of both lungs, atrophy of liver with fatty change.

CASE III—(Surgeon, Dr Neilson) T C, age 29 years
Diagnosis On admission, submaxillary adenitis and sublingual
cellulitis Revised, Ludwig's angina Result Recovered

Was admitted to hospital April 21, 1908

Present Illness—Began one month ago with a swelling beneath the right inferior maxilla This was painless and hard and of very moderate size For past three weeks he has had neuralgia of left upper part of face One week ago he had the left canine tooth pulled This relieved his neuralgia A few hours later the submaxillary swelling had increased Upon the following day he noticed sublingual oedema of right side only and swelling of right side of his tongue This swelling rapidly increased so that on the morning of April 17, 1908, the tongue filled the posterior part of his mouth, touching the palate On the left side of the tongue there was a small air-passage He could breathe freely by the nose Pain was due to pressure of tongue on the teeth Speech was interfered with on account of inability to move his tongue freely Says he was not hoarse His breath was very foul Saliva was increased to an enormous degree and was sticky and thick Appetite was poor He was able to swallow "milk and raw eggs," says that he would get this mixture in the anterior part of his mouth and then close the mouth and push the tongue forward like a wedge and thus force the mixture into the throat and swallow it Temperature was not taken before 4-18-'08, and he does not know the degree He slept in a sitting posture and the saliva would run from his mouth His attending physician cut into the sublingual tissue but found only blood

When admitted to hospital, April 21, his temperature was 100°, pulse, 72, respiration, 24 Fairly well nourished man who appears to be under tone Face is drawn and cheeks are hollow Pupils react Tongue is coated gray throughout It is swollen, especially on the right side, and posteriorly it touched the roof of the mouth Speech is thick Sublingual tissues are moderately oedematous on the right side only from the midline posteriorly and are higher than the cutting edges of the teeth A small gray membrane to the right of the midline of the sublingual tissues marks the point of the attending physician's incision Right first molar is carious and other teeth contain cavities In the right submaxillary region there is a hard swelling slightly

nodular extending from the midline to the angle of the jaw This swelling is not very prominent Heart and lungs are normal

11 30 A M He says that he expectorated three large masses of yellow-greenish mucopurulent material of very bad odor and taste one after another These seemed to come from behind his tongue He began to rapidly improve Swelling of tongue decreased and he is able to speak more clearly

3 30 P M Examination shows no discharging point, although the sputum cup is full of mucopurulent material and thin watery matter This has a bad rotten taste

5 30 P M Operation by Dr Price sublingual tissue is still œdematous and an incision is made into it, starting at the midline and going back to the last molar tooth A curette is inserted ($1\frac{1}{2}$ in) and used thoroughly A great deal of blood that clots instantly is removed, also small bits of caseous material—possibly glandular A small amount of light greenish mucopurulent material is seen This seemed to come from near the midline. The curretting caused little pain Pressure on the outside did not increase the flow Cultures from incision showed "*micrococcus salivarius*—Biondi" *

During the day thereafter, sublingual œdema and swelling of tongue became very much less General condition very satisfactory

By the third day the tongue was normal Sublingual œdema slight

Steady improvement thereafter, patient was discharged on the ninth day

CASE IV—(Surgeon, Dr Neilson) J D, age 22 April 24, 1908, a dentist injected cocaine around the first right molar in the lower jaw and extracted the tooth Two days later he noticed a very hard painful swelling below the right inferior maxilla, began to lose his appetite, had slight headache and malaise, causing him to stop work after five days May 1, he had difficulty in talking and swallowing, his voice was husky.

* *M. salivarius*—Biondi—Morphology, cocci round slightly oval, stain by Gram's method, gelatin colonies, surface round, grayish-white, which may become darker, gelatin stab, in depth beaded, white, potato growth scanty, pathogenesis, inoculations of mice, guinea pigs and rabbits cause death in four to six days, cocci in organs, no inflammatory reaction in tissues, habitat, saliva of man

After another day he had difficulty in breathing May 3, he came to the hospital surgical dispensary when sublingual œdema was observed by Dr Ivy Then patient refused to remain in the hospital The swelling continued to increase in size until 8 P M He had dull pain through his neck and cough and increased saliva By the next day he had such difficulty in opening his mouth that he said he thought he was getting lockjaw and came to the hospital He has been unable to sleep He was finally received at the hospital May 4, 1908 He walked to the hospital When admitted his temperature was 99.2° Pulse, 92 Respiration, 26 Blood leucocytosis, 12,200 The right cheek is swollen There is a hard firm swelling the size of a half egg in the right submaxillary region The submental region is also swollen from the symphysis to the hyoid bone and extends two fingers to the left of the median line The sublingual tissue on the right side is markedly œdematous, being above the cutting edges of the teeth and pushes the tongue upward On the left side it is only slightly œdematous The tongue is covered with a gray pia It is not swollen but it cannot be protruded beyond the lips The face is flushed and the pupils dilated Chest lungs, left-apex resonance is impaired The breath sounds are harsh Remainder of lungs are clear Heart muscular tone is good No murmurs Abdomen is normal

2.45 P M Operation by Dr Price One incision is made in the median line from without inward through the floor of the mouth A second incision is made over the right submaxillary triangle through the mylohyoid muscle A hæmostat is passed in beneath the mylohyoid from the lateral incision to the median incision and a rubber drainage-tube is inserted through and through A third incision is made in the right sublingual tissue and a curette inserted Nothing but blood and bloody serum removed The blood clots instantly No pus found Wet dressing applied Alcohol 65 per cent Bichloride of mercury 1-4000 aa Patient says that he feels much relief Says that he can talk better

7 P M Patient is expectorating large amounts of saliva and blood and blood-clots

5-5-'08 Had only few short naps during the night

(1st day) Says he feels much better than before the incisions were made Has less difficulty in swallowing and talking

FIG 1



CASE IV —J D Showing the swelling in the submaxillary and submental regions, also the incision and drainage tube into the submaxillary triangle

FIG 2.



CASE IV —J D Showing the drainage tube passing from the incision in the submaxillary triangle to the median incision in the submental region

FIG 3



CASE IV —J D Showing swellings of the right cheek, submaxillary and submental regions

His voice is still husky. He still has pain on swallowing. No headache. No appetite. No shortness of breath. This A.M. his expectoration consists of a thick ropy mucopurulent material. Redressed. Discharge is bloody. Small amount of pus about the ends of the rubber tube. The sublingual and submaxillary swellings are about the same as yesterday.

(2nd day.) Examination shows increased sublingual swelling on the left side. Sublingual tissues extend above the level of the edges of the teeth. The submaxillary swelling on the left side has increased and is very hard. The left cheek is swollen. (Right side.) The submaxillary and sublingual swellings have markedly decreased and the submaxillary region is not so hard. Right cheek is still slightly swollen.

Second operation by Dr. Price. An incision one inch long, parallel to the inferior maxilla over the left submaxillary triangle, is made through the skin and mylohyoid muscle. A hæmostat is inserted and opened in all directions. To the left of the median line, one-half dram of pus is found. One or two large gas-bubbles are seen to come out with the pus. Cultures are made. The median incision is enlarged and a rubber drainage-tube is inserted through and through from the median line to the left lateral incision beneath the mylohyoid muscle. Original tube is removed and a fresh one is inserted in the region of the lateral incision. Wet dressings. Alcohol 65 per cent. Bichloride mercury, 1-4000 aa applied. (5 P.M.) Blood. Leucocytosis, 13,800 (6 P.M.) General condition is much better.

(3rd day.) Feels stronger. Sputum is foul and bad-tasting. He expectorates about two cupfuls each day, and each night. Examination shows all swellings much less than this A.M. Sublingual tissues especially appear almost normal. Swelling of right cheek has disappeared and swelling of left cheek is slight.

(4th day, 5-8-'08.) Blood leucocytosis, 8160. Slept almost the entire night. Expectoration for the night is one cupful. Appetite is better. Temperature, 98°.

Examination.—Swelling of left cheek has disappeared. Submaxillary and submental swellings are slight. Sublingual tissue appears about normal. Discharge is less and very foul. Steady improvement from this date and he was discharged from hospital well on tenth day.

Cultures from incisions showed *micrococcus salivarius*—*Brondi*

CASE V—(Surgeon, Dr Neilson) C B, female, age 16 years May 1, 1908, patient had the first right molar extracted May 8 she had cocaine injected around the second right molar and the tooth was extracted On the following day she noticed a submaxillary swelling that was very hard and painful Two days later she noticed sublingual œdema, also a hard swelling in the submental region She complained of difficulty in swallowing and was able to sleep only three hours during the night The sublingual œdema increased and the swelling below the jaw became larger and more painful and tender Also difficulty in swallowing Difficulty in talking Her voice is husky Difficulty in opening her mouth Loss of appetite, headache and malaise Breathing is not affected Increased saliva that is thick and ropy Applied for admission to hospital on the twelfth of May

Physical Examination—Well-nourished girl Mouth numerous carious teeth The first and second molars are missing on the right side The gums at this point is covered with a thin grayish-yellow slough The sublingual tissues on the right side are œdematous but do not quite reach a level with the cutting edges of the teeth, on the left side they are slightly œdematous There is a swelling of the right side of the face and neck extending from the malar bone to the sternum The swelling over the submaxillary triangle and the submental region as far as the hyoid bone is very hard and of a shoe-leather resistance There is no fluctuation The anterior cervical lymphatics are palpable as a small chain of beads on the right side only The thyroid gland seems slightly enlarged W B C, 20,440

Operation by Dr Price immediately after admission Local anæsthesia with ethyl chloride Two incisions are made One over each submaxillary triangle, parallel with the jaw and about one inch long The incisions passed through the mylohyoid muscle There was a free flow of blood and serum Nothing that could be considered pus was seen The subcutaneous tissues were quite œdematous A hæmostat was inserted and opened in all directions and passed beneath the mylohyoid muscle from one incision to the other A rubber drainage-tube was inserted through and through Immediately relief followed the operation

The following day the submaxillary and sublingual swellings were decreased. In the submental region the tissues were still quite hard. The swelling from the hyoid bone to the sternum had entirely disappeared. Patient much more comfortable. She expectorates a thick ropy white sputum profusely. Breath is foul.

Gradual subsidence of all symptoms, resulting in full recovery and discharged well on the eleventh day.

Cultures from incision showed *Bact. ferrugineum* (Dyal) and from aspirated material showed large diplococcus, small diplococcus, long, thin bacillus, shorter, thicker bacillus, streptobacillus (strepto-diplo-bacillus?)

REFERENCES

- Davis, Am J Med Sc, Feb, 1904.
Davis, Annals of Surgery, 1906
Thomas, Annals of Surgery, 1908
C J Aldrich, Med News, June 27, 1903
W O Humphrey, Am Pract and News, Louisville, 1904
Seymour Taylor, Lancet, March 21, 1896
F Murchison, Brit Med J, 1875, 778
Klein, Med Clin Centralblatt, Wien, xv, 193
Leube, Spezielle Diagnose, Bond 1
Harris, Med News, Sept 3, 1904
Chester, Determinative Bacteriology, 1901

TUMORS OF THE BREAST IN CHILDHOOD

BY JOHN H JOPSON, M D.,

Surgeon to the Childrens' and Presbyterian Hospitals

JOHN SPEESE, M D.,

Assistant Demonstrator in Surgery, University of Pennsylvania

AND

C Y WHITE, M D.,

Pathologist to the Childrens' and Episcopal Hospitals, Philadelphia, Penna

THE recent occurrence of two cases of tumor of the female breast in children in our own practice has induced us to make some further study on the general subject of tumors of the breast in childhood. A search of the literature has shown an apparent absence of systematic papers on the subject and we have thought it worth while to collect and analyze the scattered cases of these unusual affections. To the paper of Malapert and Morichau-Beauchant² we are indebted for the cases of angioma of the breast included in our own series. The remaining cases have been collected from the literature at large, mainly from case-reports in the journals. In addition to the complete histories of our own cases, we have made brief abstracts of all the other cases which we could find and analyzed them with reference to the pathology, symptomatology and treatment.

A large majority of tumors of the breast in childhood are benign in character. They may be conveniently divided into benign tumors of vascular origin and benign tumors other than those of vascular origin.

Vascular tumors of the breast exist as cutaneous, subcutaneous or intraglandular formations. This subject has been thoroughly investigated by Malapert and Morichau-Beauchant² from whose article on the subject most of the data here collected has been obtained. They have collected and analyzed all the recorded cases of angioma of the breast, among these were six, including one of their own, in children under sixteen years

of age The first class are unimportant, have the characteristics of *nævi* occurring elsewhere, and are apt to be seen on or near the nipple Bryant³ reports a case the size of a shilling, which was destroyed by the galvanic cautery

In the subcutaneous variety the cellular tissues are invaded by small tumors which may cause atrophy of the glandular structures by pressure They are small, nodular, circumscribed and the overlying skin is healthy The intramammary forms of glandular tumors are true angiomas of the breast although it is difficult in certain cases to recognize the precise origin of the tumor If situated near the nipple the glandular tissues may undergo atrophy but the ducts persist because of their greater resisting power The affection may be diffuse as in Bajardi's¹ case, or less often, encapsulated Both sexes are affected with equal frequency, the growths occurring either at birth or in the earliest months of life, and they may exist for years if not treated The symptoms vary, at times an erectile tumor may be present, which is painless, the skin normal except for the presence of a few enlarged veins In other cases, cysts may exist due to the presence of degeneration in the tumor In outline the tumors are usually smooth, sometimes nodular, may fluctuate if cystic, are of slow growth and may bleed if ulceration of the skin occurs There is a decided tendency toward involvement of the right breast as shown in six of the eight cases reported; in one instance only (Bittner) was a bilateral tumor present

The treatment of vascular tumors of the breast depends upon their seat and size Small superficial tumors require no treatment, or may be destroyed by the cautery, as was done in Bryant's case The larger tumors, situated in the breast proper, require extirpation and in some instances are of such size, that complete removal of the breast may be necessary

The reported cases of this type are as follows

I MALAPERT²—Girl aged 12, developed an enlargement of right breast fifteen days after birth, and at the age of six months a decided enlargement was present There was no pulsation in the tumor, which did not enlarge on straining and was painless On palpation a smooth, fluctuating tumor, the size of an orange, was apparent, the skin free,

the mass movable on the underlying structures Operation Removal of three cysts and a solid mass, the microscopic examination showing an angioma with some breast-tissue remaining

2 BAJARDI¹—Child 2 years of age, tumor of right breast noted six months after birth, later attaining size of an orange Skin blue around nipple The tumor was slightly adherent to nipple which was slightly retracted, and on palpation was soft and elastic It was reducible and was made tense on straining Operation Excision of tumor and nipple Microscopic examination Angioma with atrophy of breast-tissue

3 COLZI²—Boy aged 10 had enlarged right breast since early infancy The tumor grew slowly until the whole gland and nipple were involved The microscopic examination of the tissues removed showed an angioma and pressure atrophy of the breast

4 ALTHORP⁴—Boy aged 7, tumor in right breast since birth, very slow in development until the subject of trauma when it increased rapidly The skin became discolored, the superficial vessels enlarged The tumor was lobulated, movable, and fluctuating Operation Excision of cystic tumor containing 30 oz fluid Microscopically the mass consisted of angiomatous and muscular tissues

5 WILLIAMS⁶—Boy aged 7, developed a tumor in right breast, outside and below nipple, which was not involved The growth was of five months' duration, about the size of a half crown, and firmly adherent to the breast Diagnosis Degenerated angioma Operation Removal of breast

6 BRYANT⁵—Girl aged 15 weeks, tumor involved whole breast and skin, nipple retracted The tumor measured two inches in diameter, was spongy and prominent, covered by large veins The whole swelling could be reduced by pressure No treatment was instituted

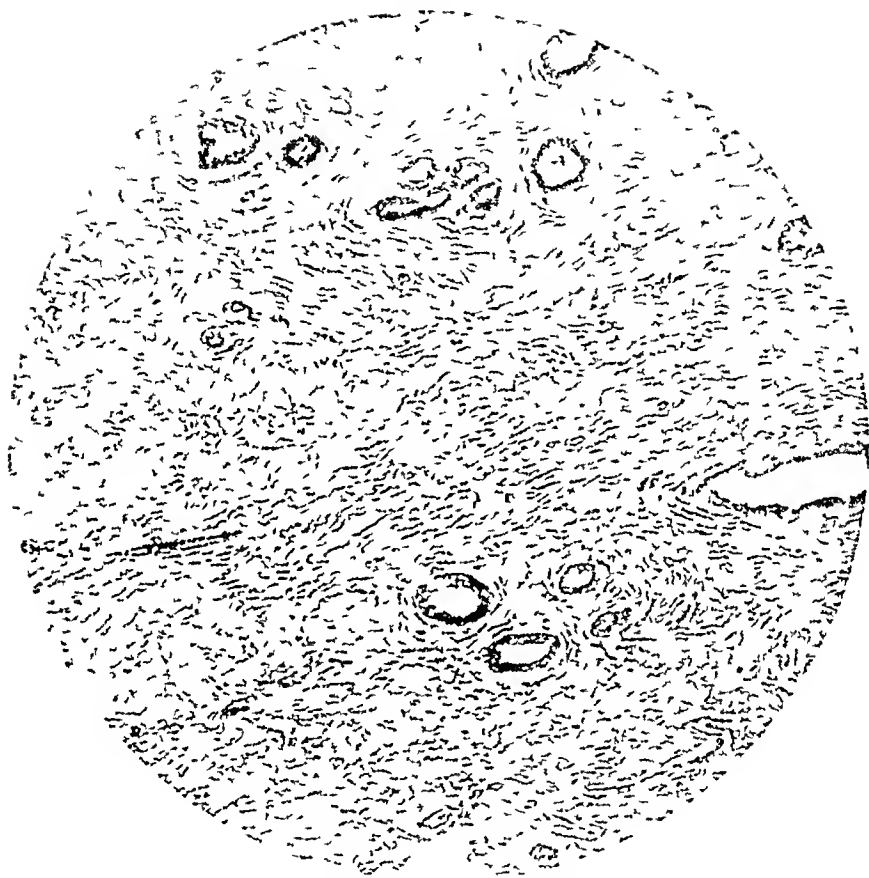
BENIGN TUMORS OTHER THAN THOSE OF VASCULAR ORIGIN.

As in the adult breast we encounter a variety of benign tumors of this type in the mammary gland in children In describing these types they may be grouped clinically as benign, as the symptoms they produce are fairly constant In most of the cases the tumors consist of a hypertrophy of both fibrous and epithelial elements, giving the usual appearance of fibro-epithelial growths as seen in the adult, and can be classified, therefore, as fibro-adenomata A few instances of cystic disease of the breast and of lipoma in children are on record

The two cases which follow were observed by us and are reported for the first time

I F W, female, aged 10 years, was first seen in January, 1907, in the Surgical Dispensary of the University Hospital The

FIG 1



CASE I—Adeno-fibroma of the breast in a girl of 10 years

FIG 2.



CASE II—Diffuse fibroma of the breast in a girl of 11 years. The general enlargement of the gland tense and shining integument and dilated subcutaneous veins simulated a sarcoma.

child was poorly nourished and slightly anæmic. She complained of pain and tenderness in the left breast, particularly in the region of the nipple. There had been no traumatism suggestive of a cause of the pain. On examination the breasts were found to be in an undeveloped state, although the left one was slightly larger. Palpation caused some pain, and revealed a slight thickening of the tissue beneath the skin, local measures were instituted and the mother advised to have the child return if she noticed any subsequent enlargement of the breast. The condition remained unchanged for ten months when there was a decided increase in the size of the breast, which became more painful especially if handled. When examined one year after the first visit and two months after this decided enlargement, a small mass the size of an almond could be readily palpated. It presented the usual symptoms of a small adenofibromatous growth, being freely movable, and the overlying skin not affected. Enlarged axillary nodes or dilated veins were not present. Because the tumor was in intimate relationship with the nipple, the possible danger of atrophy of the breast following removal of the growth was considered and explained, and operation advised in view of the possible malignancy due to the sudden increase in size. The operation was performed by Dr John Speese. The rudimentary gland was exposed by an incision $1\frac{1}{2}$ inches in length at its base, and the tumor removed. It was encapsulated, slightly adherent to the portion of the gland beneath the nipple, so that in its removal it was impossible to avoid some injury to the ducts, it was easily stripped from the pectoral fascia. The incision was closed by a few interrupted sutures and the wound healed rapidly with practically no scar. *Microscopically*, the tumor consisted of a fibroepithelial formation showing a typical adenofibromatous growth (see Fig 1). The glandular part consisted of a few acini, the greater portion being derived from the ducts, which were lined with cuboidal epithelium.

II Addie P, colored, aged 11. Admitted to the Children's Hospital, April 23, 1907. Service of Dr J H Jopson. An only child. Both parents living and well. No history of specific or malignant disease. No illness except measles and pertussis. Has never menstruated. Enlargement of right breast, stated to have been noted first by the child some eight weeks before. Mother

has observed it for four weeks, during which time it has rapidly increased in size. Occasional sharp pains in breast for several weeks. No other symptoms complained of.

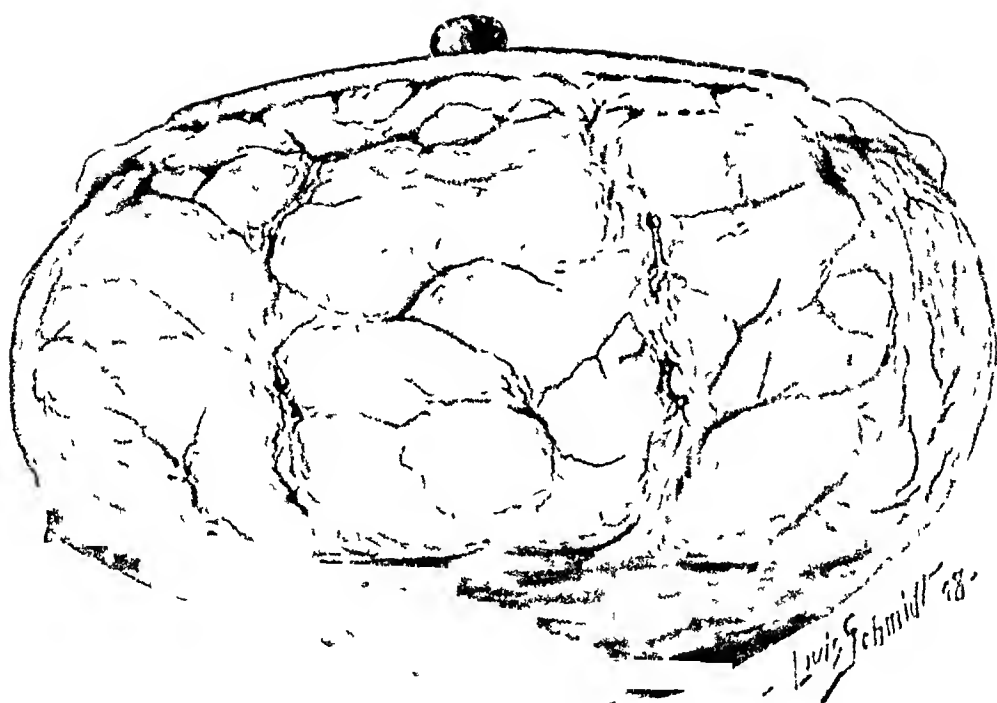
Physical Examination—Patient is well developed for her age. General nutrition good. Examination of heart and lungs negative. Abdominal examination, negative. The right breast is enlarged, globular in shape, nearly three times the size of left. It is very hard. The skin is tense and shiny. Numerous large subcutaneous veins radiating from nipple. The nipple is flattened and partially retracted. No special tenderness. Breast is very movable on underlying tissues. One or two small glands are palpable in the axilla. (See Fig 2) *Diagnosis*—Sarcoma.

Operation—April 26, 1907, amputation of breast. Elliptical incision, greater part of skin covering breast sacrificed with it. Great vascularity of subcutaneous tissue. Pectoral fascia was cleaned from muscle, which was not removed. Thorough dissection of the axilla from below. Several enlarged glands were found. Their appearance suggestive of sarcomatous infiltration. Undermining of skin edges was necessary to closure of wound, which was accomplished except for a central area about the size of a silver dollar. Primary healing of wound. Patient discharged from hospital June 13, 1908.

Laboratory Report—The tumor when received measured about $6\frac{1}{2} \times 4\frac{1}{4} \times 3\frac{1}{4}$ " The overlying skin including the nipple was intact and freely movable on the tumor. The nipple showed marked retraction. The tumor mass of an irregularly moulded shape, its consistency firm throughout and of marked density. Section of the tumor showed it to be composed entirely of pale whitish glistening tissue, poorly supplied with blood. On section the tissue was arranged in rounded masses composed of whorls of glistening white striations, this appearance was continuous throughout all portions of the tumor (Fig 3).

Histological Examination—Blocks of tissue for examination were taken from various portions of the tumor mass, those from the surface showing a distinct fibrous capsule consisting, for the most part, of typical old connective tissue fibres. Directly beneath this capsule the tumor was made up of elongated spindle shaped cells closely packed together and arranged in whorls (Fig 4). These cells were of the fibrous tissue type and characteristic in arrangement and number of the cells found in rapidly growing tumors composed of fibrous tissue. Numerous ducts were seen throughout the tumor, which were lined by cells of a cylindrical type, arranged in some places in one layer, and in others, in several layers. Some of the ducts showed an enlarged lumen re-

FIG 3



CASE II —A section of the breast and tumor, showing the diffuse nature of the growth

sembling cystic formation, and in such localities the epithelial lining was flattened and atrophic from pressure. In no place had the epithelium broken through the basement membrane or infiltrated the surrounding tissues. The breast tissue had practically disappeared except for the presence of these ducts scattered through the tumor, and its place and bulk were represented by the new-formed fibrous tissue.

Pathological Diagnosis—Diffuse Fibroma. Histological examination of several small lymphatic glands showed moderate congestion and no evidence of tumor metastasis.

We have collected from the literature thirteen cases of this type, abstracts of which follow.

WEINOKOURT.⁹—Girl 13½ years of age. Left breast noticed to be enlarged fifteen months before, but not painful. Growth stationary for ten months, when it rapidly increased until three times the size of opposite gland, no pain. Tumor occupied entire left breast, hard, size of two fists, movable. Removal of breast; cured; Diagnosis: adenofibroma.

PATTERSON.¹¹—Girl, 13 years, tumor developed seven months after injury, slow growth, no pain or tenderness, not adherent, almond sized, lobulated. Tumor removed, Diagnosis: adenofibroma.

PATTERSON.¹¹—Girl aged 12 years, noted a lump in right breast three months ago, painless. Apparently disappeared, but reappeared in one month, causing pain, and gradually growing until it was size and shape of a fig. Growth situated below nipple and not adherent, but tender and sensitive. Operation. Removal of tumor. Diagnosis: adenofibroma.

BARTON.¹⁷—Girl aged 12, swelling of left breast, when first noticed was size of pigeon's egg, and painless. In two months' time was four times size of opposite breast, covered by dilated veins, lobulated, freely movable, nipple and glands normal. Operation: Removal of breast. Diagnosis: adenofibroma.

CARTLEDGE.¹²—Girl aged 16 years, right breast seat of a tumor, situated midway between nipple and axilla. Rapid in growth, painful, superficial veins enlarged. Tumor movable, size of goose egg, not adherent to gland. Operation. Entire breast removed, probably fibroma.

HOPKINS.¹⁰—Girl aged 11, four years previously had tumor, size chestnut, removed from right breast. Six months after operation left breast enlarged, later very rapid growth and enlargement of axillary nodes. Never menstruated. Entire breast and four nodes removed. Diagnosis: Fibroma. First tumor probably same type.

LEDOUBLE.¹⁸—Girl aged 15, rapid increase in size of both breasts following cessation of menstruation. Nipple flattened, overlying skin tense and containing large veins, pain of lancinating character, discomfort from weight of breasts. Diagnosis: Hypertrophy, under palliative treatment there was a diminution of left breast, right one increased in size and finally was amputated, weight being 1985 Gm. Microscopical examination: fibro-adenoma, preponderance of fibrous tissue.

GUENIOT.⁷—Observed case in a girl of 14 years, breast three times

its normal volume, lancinating pains and enlarged nodes of the axilla were palpable. Diagnosis not given.

HAYNES⁸—Girl aged 13, developed an enlargement of both breasts about nine months before. There was slight pain on pressure, which symptom soon disappeared. Five months after the enlargement began, the left breast grew very rapidly. An examination showed that the breast extended to the ilium when the patient was standing. The nipple was flattened and the region about excoriated. The breast was freely movable on the deeper structures but was not painful and only inconvenient by reason of its weight and size. The axillary glands were not enlarged. The breast when amputated weighed exactly eight pounds, and was reported as a fibroadenoma undergoing mucoid degeneration.

PARSONS¹⁸—Child 3 years of age, enlargement of left breast noted eighteen months previously, slow growth, no pain or discharge from nipple. Mass was size of an egg, cystic in character, adherent to skin, nipple normal. No tenderness or enlarged nodes. Removal of tumor and part of pectoral fascia. Diagnosis Cyst, containing clear fluid within and a smooth wall.

SPENCER¹⁵—Boy aged 4, lump in right breast since birth, round, tense, size of pea, painless. Rapid increase in size during the last three weeks, when it became size of egg, skin normal, no discharge from nipple, no nodes palpable. Exploratory puncture gave bloody fluid. Breast amputated. Was seat of multiple cysts and a solid growth, size of hazel nut. Probably cystic fibroma.

ATKINS¹⁴—Records an enormous lipoma, 25 pounds, in girl of 16 years. At the age of 4 years parents noticed a slight enlargement of left breast, which increased slowly and without pain until she was 12 years old. Then tumor began to enlarge very rapidly. Right breast was normal. Catamenia have not appeared. Growth removed. Operation followed by cure. Diagnosis lipoma.

BRYANT¹⁸—Male, aged 10 months. Hard tumor size of walnut situated above and to outer side of left nipple, moving freely upon the deeper parts, skin adherent but not discolored. Four months before began to grow rapidly. Composed of fatty and fibrous tissue.

We have carefully analyzed these 21 cases of benign tumors of the breast in so far as the data, often scanty in the original reports would permit. We have made the usual age limit of 16 years. In only one of the cases in the older girls, was menstruation mentioned as having occurred, and in several others it was stated that it had not occurred.

First with reference to the type of tumor and its relative frequency. Eleven of the 21 cases can be classified as fibromata or fibro-adenomata. The dividing line between these

FIG 4



Histological structure of the tumor in Case II It is made up for the most part of elongated spindle-shaped cells arranged in whorls

two types of tumor if it exists at all, is a very indefinite one and we are inclined to follow the classification of Ribbert as adopted by Warren, Rodman and other writers on this subject, and consider them as fibro-adenomata. They constitute the most numerous of any type of tumor of the breast occurring in childhood, and their proportion to the total number of benign breast tumors is higher in children than in adults. There were six angiomas, one fibro-lipoma, one lipoma, and one simple cyst, in one case the diagnosis was not given. Fourteen of the cases were in females, five in males and in two the sex was not stated, these were probably females. In three of the six cases of angioma the tumor was in boys. In this as in other respects, angiomas are practically in a class by themselves as regards their occurrence, pathology and symptomatology.

Age —Most of the angiomas were noted at birth or soon afterward, the children, however, were often half-grown before being brought for surgical attention. The oldest was 12 years and the youngest 15 weeks. Of the other tumors, with three exceptions, the cases were 10 years old and upward. These three cases were aged 10 months, three and four years respectively, the other cases ranged between 10 and 16 years. One was 10, two were 11, two 12, three 13, one 14, one 15 and two 16 years.

The *duration* ranged from two months to 12 years. In some cases the growth was distinctly rapid from the start, but not infrequently they were of gradual development or showed a rapid increase after a long stationary period.

As already stated the angiomas were commonly congenital or appeared in infancy.

As to *causation*, in one case there was a history of traumatism before the appearance of the tumor, and in another case, an angioma, there was rapid increase in the size of a congenital tumor following injury.

Breast involved —In 9 cases the right breast was the seat of tumor, in 7 the left breast was affected, in two both breasts, and in three the location was not stated.

Location of the tumor in the breast —But little data was

furnished in this respect The growth was stated to be below the nipple in two cases, and twice in the outer quadrant

In some cases the entire breast was involved, while in others the tumor was of a localized nature, and it was difficult from many of the case reports to state to which of these two classes the case should be assigned In at least nine cases practically the entire breast was involved *Size* —The largest tumor (Atkins¹⁴) was a lipoma which weighed 25 pounds In Le Double's¹³ case the tumor weighed between 4 and 5 pounds (a fibro-adenoma), and in Haynes⁸ case (a fibro-adenoma undergoing mucoid degeneration), it weighed 8 pounds Several times the tumor was said to be 3 or 4 times the size of the opposite breast The smallest growths were the size of a walnut, almond or egg and were seen to be of a localized nature

In practically every instance the tumor, or if the whole breast was involved, the breast was said to be movable In two of these cases the skin was not adherent

Nipple —The nipple was retracted in several cases, flattened in two and said to be normal in one The skin is usually normal except for the presence of dilated veins which are not uncommon Dilated veins were described as being present in five cases, two of which were angiomas In our own case, in addition to this enlargement of the veins, the skin was tense and shining, in one case of angioma it was said to be discolored

Pain and Tenderness —In six cases pain or tenderness or both were mentioned as being present, sometimes sharp and lancinating In four cases pain was said to be absent, and in the remaining instances it was not mentioned

Lymph Nodes —These were enlarged in 3 cases, not enlarged in 5 cases, and not mentioned in the remainder

Operation —In 11 cases the entire breast was removed, and in two the axilla dissected free of enlarged lymph nodes In 8 cases the tumor was excised, once including the nipple In one case no treatment was instituted and in one it was not mentioned

Result —So far as known all the cases operated upon were cured

MALIGNANT TUMORS. CARCINOMA AND SARCOMA

The number of malignant tumors of the breast which have been observed in childhood is small. This is what might be expected in the case of carcinoma the rarity of which is well known in childhood. It is doubtful if any well authenticated case of carcinoma of the breast under sixteen years of age has been reported and Gross states that it does not occur under the age of 20 years.

P. W. Phillip²⁸ in his article "Ueber Krebsbildungen in Kindersalter," collects 390 cases of cancer reported as occurring in childhood. Of this number only 87 (22.3 per cent) withstood critical examination as to their nature, the remainder being doubtful cases. This is sufficient to show the rarity of cancers in childhood. Phillip did not find a case of mammary carcinoma under 15 years, and only one case of cancer of the uterus, while 26 cases of ovarian cancer were observed. There seems to be a relative predisposition of the ovaries to malignant disease in childhood, furnishing 20 per cent of all cases of cancer, while in adult life they furnish but 5 per cent at the highest estimate. We have found but three cancers of the breast in children, and all of these cases are doubtful in nature, and reported many years ago. They are as follows:

1 LYFORD¹⁹—A case in a girl of 8 years (Mentioned in John Birkett's article, "Diseases of the Breast," in Holmes' System of Surgery, vol. III.)

2 B. B. COOPER²⁰—Lectures on Surgery, 1851, reports a case which he thought to be cancer in a girl of 13 years. The tumor was rapid in its development, painless, and accompanied by cachexia and metastasis to the thoracic and abdominal viscera. (This may have been and probably was a case of sarcoma.)

3 BIRKETT²¹—Mentions a specimen in the Museum of St. Bartholomew's Hospital, removed from a girl of 16 years.

SARCOMA

This also is a rare disease of the breast in children. While a number of references are contained in the literature, very

meagre descriptions of the histological structure of the supposed sarcomata are furnished Gross²⁹ states that 1.66 per cent of cases of sarcoma of the breast occur during the developmental stage, that is, before the sixteenth year Karewski³¹ collected 156 cases of sarcoma of the breast of which 1 occurred before the tenth year and 14 before the eighteenth year of life There is no doubt that sarcoma is a much rarer tumor of the breast than was supposed by the older writers, a fact recently emphasized by Rodman³⁰ in his work on "Diseases of the Breast" Instead of 5 to 9 per cent of mammary tumors he estimates its frequency from an analysis of 5000 cases at 2.78 per cent The relative liability of the female breast to sarcoma is below that of the body in general and while, heretofore, it has been generally assumed and stated that it was a disease of young women, it is a fact, as Rodman points out, that one-half of the cases occur between the ages of 40 and 50 years Two explanations may be furnished to reconcile the disparity between the figures of the older writers, as Gross, and those of the present day The commonly accepted one is that a more accurate histologic diagnosis is now insisted upon and that the microscope is relied upon more than the clinical picture Another explanation which has occurred to us is, that the great increase in recent years in the number of cases of cancer of the breast, as of cases of cancers of all kinds, has not been accompanied by a relative increase in the number of cases of sarcoma of the breast

Types of Sarcoma Found in Childhood—Generally speaking, spindle-cell tumors develop at an earlier age than do round-cell tumors, while cystic sarcomas are observed more frequently in youth It may be difficult to diagnose between a rapidly growing fibroma and a spindle-cell sarcoma Thus in our second case diagnosed before operation as sarcoma, several experienced pathologists made a diagnosis of sarcoma, from some of the microscopic preparations which apparently confirmed the clinical diagnosis The liability to error before operation is not inconsiderable, for our second case presented the clinical picture of a rapidly growing sarcoma, the diagnosis being based

upon the rapid growth of the tumor, its general appearance and the presence of the distended veins in the overlying skin, an appearance which is common to sarcomata in general. A review of the cases here collected will show, however, that this latter symptom is described as present in a number of cases of non-malignant tumors of the breast in childhood both of angiomatous and fibro-epithelial origin. The following are the references to sarcoma of the breast. Scant details are furnished in the original reports.

1 SHEILD²²—A rapidly growing spindle-cell sarcoma in girl of 14 years

2 SHEILD²³—A myxo-sarcoma removed from the breast of an infant aged six months

3 CHAMBERS²⁷—A four months old child presented a small round-cell sarcoma of the breast the size of an egg. Duration, since 5 weeks. Removed. No recurrence at the age of five months.

4 BILLROTH²⁵—A child of 9 months. Sarcoma of breast. Removal.

5 HANSEY²⁶—A case seen at an early age.

6 RODMAN²⁴—A girl aged 11 years gave a history of traumatism one year before development of the tumor. Pain in breast was followed by an increase in size, the growth being fairly hard. Removal was advised on account of increased pain, and the presence of enlarged veins in the overlying skin, which the author believed indicated the tumor to be of sarcomatous type. Breast was removed. No enlarged glands were found in the axilla. Microscopic examination not made, specimen being lost.

The diagnosis was based on what may have been misleading clinical symptoms. The presence of the enlarged veins is not conclusive evidence of malignancy as shown in our own case and in several of the vascular and fibro-epithelial tumors which have been collected in this series.

CONCLUSIONS

Tumors of the Breast—While rare in childhood, occur in both sexes and at all ages.

The benign tumors are more frequently encountered in the mammary gland in early life than the malignant tumors. The fibro-epithelial growths are the most numerous group of the benign tumors, and next to these in point of frequency come the angiomata.

Sarcoma may occur in children in the mammary gland, but it is a rare tumor. The breast enjoys almost complete immunity to carcinoma before the age of puberty.

Girls are affected more frequently than boys, but the disparity in numbers is immensely less than in adults

The angiomas are commonly congenital, or first appear in infancy. The fibro-adenomas tend to develop more frequently as the child approaches puberty.

Some of the smaller benign tumors occasion no inconvenience. Others are associated with symptoms, pain, tenderness, and inconvenience or discomfort from excessive weight or size. Sarcomata present the symptoms common to that type of tumor.

Operation is usually indicated in the benign and always in the malignant varieties. In small benign tumors or those involving only limited areas, conservative plastic operations with preservation of breast and nipple are indicated. In a goodly number, however, the breast must be sacrificed. The axilla should be cleaned if it contains enlarged glands. The results of operation are good.

BIBLIOGRAPHY

VASCULAR TUMORS

- ¹ Bajardi, *Lo Sperimental*, 1892, 250
- ² Malapert, *Marichau-Bauchant*, *Rev de Chir*, Feb, 1904, LXXIX No 2
- ³ Bryant, *Wood's monographs*, IV
- ⁴ Althorp, *Lancet*, 1901, II, 914
- ⁵ Colzi, *Cit of Malapert*
- ⁶ Williams, *Middlesex Hosp Reports*, 1887

BENIGN TUMORS OTHER THAN THOSE OF VASCULAR ORIGIN

- ⁷ Gueniot, Quoted by LeDouble
- ⁸ Haynes, *Annals of Surgery*, 1906, 940
- ⁹ Weinokouroff, *Bull de la Soc Anat de Paris*, 1883, 126
- ¹⁰ Hopkins, *Boston Med and Surg*, 1885
- ¹¹ Patterson, *Jour of Anat and Phys*, 1891, LVI, 509
- ¹² Cartledge, *Med and Surg Record*, 1893, 88
- ¹³ LeDouble, *Bull de la Soc Anat*, Paris, 1875, I, 185
- ¹⁴ Atkins, *Indian Medical Record*, 1893, 41
- ¹⁵ Spencer, *Westminister Hosp Reports*, 1895, No 9, 92
- ¹⁶ Parsons, *Brit Med Jour*, April 29, 1896
- ¹⁷ Barton, *Trans Med*, Ireland, III, 290.
- ¹⁸ Bryant, *Wood's Monographs*, IV

MALIGNANT TUMORS

Carcinoma

- ¹⁰ Lyford, Lancet, No 12, 332
- ²⁰ B B Cooper, Lectures on Surgery, 1851
- ²¹ Birkett, Holmes' System, 111

Sarcoma

- ²² Sheild, Brit Med Jour, 83, 1v, 999
- ²³ Sheild, Diseases of the Breast
- ²⁴ Rodman, Annals of Surgery, 1906, 308
- ²⁵ Billroth, Quoted by Hansey
- ²⁶ Hansey
- ²⁷ Chambers, Univ Med, May, 1889-90, 376
- ²⁸ Phillip, Zeit fur Krebsforschung, v, No 3
- ²⁹ Gross, Tumors of the Mammary Gland
- ³⁰ Rodman, Diseases of the Breast
- ³¹ Karewski, Surgical Diseases of Children

BILIARY CALCULUS WEIGHING TWO AND ONE HALF OUNCES REMOVED FROM THE COMMON DUCT

BY WILLARD BARTLETT, M D,

OF ST LOUIS, MO,

Professor of Experimental Surgery in Washington University

THE object of the present communication is to place on record the successful removal of a common-duct stone larger than any which the author has been able to find hitherto recorded

The possessor of this remarkable stone was a man forty-five years of age, born in Ireland, the proprietor of coal mines

He had suffered from indigestion for twenty years, during which time colicky attacks in the right upper abdomen had been frequent. Sometimes the interval between was as long as six months, sometimes not longer than one week. There had usually been a chill and high fever accompanying the attack, and after this had subsided he had generally become jaundiced and later been troubled by intense itching. Usually he was so ill he had to go to bed and have morphine for the pain. Vomiting, which was common, had very little effect as far as relief of the suffering was concerned.

The region of the gall-bladder is distinctly sensitive. The skin and scleræ are tinged a deep yellow. The pulse is slow and there are marks of the finger-nails to be seen all over the body. Dr Hugo Summa, who referred the patient to me, was able with bimanual examination to palpate a hard mass in the right abdomen at about the usual site of the common duct. (This mass proved to be the stone. it must be very rarely possible to palpate a common duct stone *in situ*.)

Operation January 2, 1906. The gall-bladder was considerably distended, contrary to the law of Courvoisier, and contained thousands of tiny stones together with much sand and stinking bile. The common duct was of such size and thickness that we at first mistook it for some other organ or new growth. When,



Calculus removed from ductus choledochus communis

however, it was incised an immense stone was found and broken during removal. The hand of the operator could be introduced into the cavity which was left. One peculiarity about this duct was that it had not dilated symmetrically but to the right side of its axis. The immense opening was sutured up to a large rubber tube which was left for bile drainage. Strips of gauze were tied to the stitches and a rubber tube was inserted through the back.

The patient's convalescence was rather protracted on account of suppuration in the abdominal wound, but he made an ultimate excellent recovery and was walking about the hospital one month after the operation. I saw him five months after when in splendid health and weighing more than he ever had in his life before. About a year later I learned that he had died but could not determine any further particulars.

This unusually large calculus weighed two and one-half ounces when removed. It is four inches in length by one inch and a half in breadth. The chemical examination of it made by Dr. Rush shows its organic constituents to be as follows:

Cholesterine, making up a large proportion of the substance, bilirubin, also in large amount, urobilin, trace, sodium, potassium, calcium, magnesium, copper and iron (manganese indicated in preliminary but not confirmed), carbonic, sulphuric, hydrochloric, nitric, phosphoric and silicic acids.

ACUTE DILATATION OF THE STOMACH COMPLICATING TYPHOID FEVER

BY CUNNINGHAM WILSON, M D,

OF BIRMINGHAM, ALA

ACUTE dilatation of the stomach is a condition receiving at the present time no little attention I have been unable to find in the literature at my command a report of this condition occurring as a complication of typhoid fever I report below such a case, which I think of enough importance to call to the attention of the profession

Miss T, age 22, suspected typhoid perforation Acute dilatation of stomach Exploratory laparotomy, recovery This patient was admitted to St Vincent's Hospital under the care of Dr H S Ward, on March 30, 1907, at the end of the first week of typhoid fever On admission her temperature was 103, pulse 100 On the day after admission, the patient had a small hemorrhage from the bowels With the exception of the fact that she did not take her nourishment well, there was nothing unusual up to April 14, when she began to complain of considerable abdominal pain This was accompanied by a slight degree of tympany Pulse ranged from 110 to 120, temperature 102 Patient vomited occasionally After giving $\frac{1}{4}$ gr morphine hypodermically, these symptoms became less in intensity

April 15 Patient had another attack of abdominal pain Vomiting at frequent intervals Tympany much more marked At 3 P M patient's condition was extreme, temperature 102, pulse ranged from 110 to 140 and was irregular in rhythm Abdomen markedly distended Abdominal respiration absent through abdominal muscles not definitely rigid Operation April 15 Under ether the abdomen was opened and found entirely filled with what proved to be a distended stomach The lower portion of the stomach was tightly wedged in the pelvic cavity and its upper border was found high up in the epigastrium A stomach-tube was introduced and a large quantity of gas and bile-stained fluid, containing a large amount of mucus was removed The stomach

now became collapsed and resumed its normal position. Before removing the tube, the stomach was washed out until the fluid returned clear. The abdominal cavity contained a considerable amount of serous fluid. This was carefully mopped out. A quart of normal salt solution was now poured into the cavity and the wound closed without drainage. During the next few days the stomach was washed out several times. The patient made an uneventful recovery. This case was not, strictly speaking, a surgical condition, but the diagnosis was not made before the exploration.

ACUTE HÆMATOGENOUS INFECTION OF ONE KIDNEY IN PERSONS APPARENTLY WELL.

A REPORT OF EIGHT CASES

BY FARRAR COBB, M D,

OF BOSTON, MASS.,

Assistant Visiting Surgeon to the Massachusetts General Hospital

It is not well understood as yet by the profession that in persons apparently in good health septic infarcts of the kidney may be caused by bacteria, usually colon bacilli, circulating in the blood, and that the acute cases of this form of hæmatogenous infection can present a typical picture of certain of the grave abdominal emergencies,—appendicitis, cholecystitis or visceral perforation, with abdominal tenderness and rigidity, vomiting, high pulse, temperature and leucocytosis

Only a few cases have been reported and several have been diagnosed incorrectly before operation. Among the earliest cases reported was one by A. T. Cabot, of Boston, in 1901, in an article entitled *Idiopathic Abscess of the Kidney*. Dr. Brewer, of New York, has done much to call attention to this subject. My first case was operated upon in 1903 and reported in 1907.* The disease is one of great interest and I am convinced that many more cases must be reported and the whole question discussed with emphasis before medical men in general are made to realize that such a condition can occur and that its proper diagnosis and treatment are matters of the utmost importance. For this reason I wish to report here eight cases from the surgical wards of the Massachusetts General Hospital, all of them operated upon since 1902. Dr. F. B. Harrington and Dr. W. M. Conant have very courteously given me permission to report their cases with my own. Six

* Acute Hæmatogenous Infection of one kidney in persons apparently well. Report of a case and a study of the subject. *Boston Med and Surg Jour*, Jan 24, 1907, clvi, No 4, 97

of the cases have been shown by me at meetings of the Staff of the Hospital and also by invitation at the meeting of the American Society of Clinical Surgery in May last

These infections while comparatively rare are not so infrequent as past experience would show. In all probability they have not been recognized in the early stages of the infection. My own experience since 1902 includes six cases, one of them operated upon twice, and in the four months from October to February last two cases were operated upon by Dr Conant, one by Dr Harrington and three by myself. The records of the above mentioned hospital for 20 years, from 1883 to 1903, however, show only four cases of operation for undoubted hæmatogenous infection of the kidney, in three of which infection occurred without known cause while the individual was in a condition of good health. Johnson analyzed all the cases of surgery of the kidney at the Roosevelt Hospital for eight years preceding October 1, 1898. There were twelve cases operated upon for abscess of the kidney, all but three of which had an undoubted origin in ascending infection and pyelitis. In only three cases was it at all probable that acute hæmatogenous infection of the kidney had been the origin of the abscess.

Infection of the kidneys may be ascending, the urogenous type, or an infection from the blood, the hæmatogenous type. It may take place also through wounds or by extension from other abscesses in the immediate vicinity of the kidney. In any condition where bacteria are plentiful in the blood stream or in general infectious diseases or where local sepsis exists, hæmatogenous infection of the kidney can occur provided conditions favor it. This infection may be mechanical by actual minute bits of infected tissue carried to the kidney and arrested in some of the terminal vessels. This is the commonest form of hæmatogenous infection and is to be expected in extensive suppuration elsewhere, in septicæmia, pyæmia, ulcerative endocarditis and the like. These true embolic infections usually involve both kidneys, and in the pre-antiseptic days when septicæmia and pyæmia were common, were a frequent cause

of death The infection, however, may be by bacteria themselves which are circulating in the blood and for some reason lodge in the terminal vessels of the kidney This infection usually involves only one kidney, and while it may occur in any of the septic conditions mentioned or in infectious diseases, it is of the utmost importance to know that it does occur much more frequently than is realized in persons previously in apparent perfect health

These infections are interesting clinically and also from a bacteriological standpoint The right kidney is said to be more frequently involved than the left No explanation for this has been found In the cases reported here the right kidney was infected in five and the left in three cases When an acute infection of the right kidney occurs the symptoms may suggest exactly acute appendicitis or acute cholecystitis (see Cases III and VII) More cases occur in women than in men and especially in those who have borne children Only one of the eight cases herein reported was a man Four of the women had borne children

In persons apparently well the onset is usually acute and without warning The course of the disease may be rapid, with increasing toxic symptoms, or after an acute onset the patient may go for weeks or months in a septic condition The very acute cases are the ones which simulate most closely abdominal infections On the contrary in a small number of cases infection may manifest itself by slight pain in the back and a long continued fever with or without pyuria, which symptoms may never lead to a suspicion of the kidney In the existence of septic conditions elsewhere or infectious disease, it is easier to suspect an infection of the kidney than when such symptoms come without warning It should be understood also that in any condition of health or disease bacterial localization may take place in one or more of the terminal vessels of the kidney causing at the time very slight symptoms, but that such cases can go on to more or less extensive abscess formation without rupture of the abscess or abscesses into the kidney pelvis or into the perirenal tissue

In advanced stages of renal abscess it is difficult if not impossible to decide whether the infection came through the blood or lower urinary tract. In the course of some other disease bacterial infection of one kidney may never be recognized as a complication. Many of the large lumbar abscesses following typhoid and other infectious diseases may originate in such focal abscesses in the kidney cortex with late perforation into the perirenal tissue.

Before proceeding further with the discussion of the subject, I will give a history of one of the acute cases somewhat in detail in order to illustrate the striking similarity of such cases to acute abdominal infections and to emphasize the uncertainties of diagnosis.

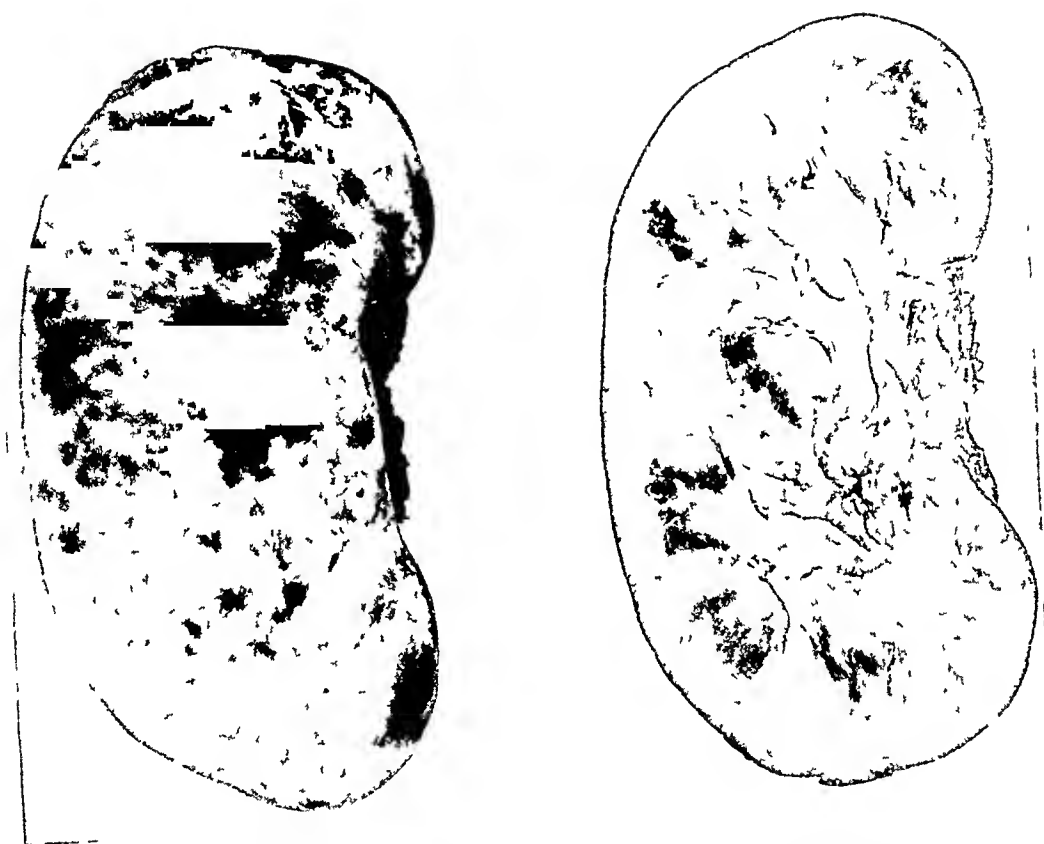
CASE I (*Fulminating case simulating gastric or duodenal perforation. Operation 26 hours after first symptoms. Infection colon bacillus*) Rose H, 23 years old, married, saleswoman by occupation, white, entered the hospital through the accident room December 7, 1907. Aside from children's diseases her previous history was unimportant. She had been married three years, and but for slight irregularity in menstruation and some leucorrhœa and occasional "nervous attacks," had considered herself well. She had had no children and no miscarriages. Up to a few months before she was constipated, since then the bowels have been loose, about three movements a day. She had noticed nothing unusual in the character of the movements. For three weeks previous she had not felt as strong as usual and had been somewhat drowsy and stupid. She did not consider herself sick, however, and was able to work every day. Twenty-four hours before entrance while at work in the store, she was seized with a sharp stabbing pain in the abdomen, especially on the left side high up, it was so severe that she fainted. The pain increased in severity and became general over the abdomen. The most severe pain was described as starting just below the ribs on the left radiating into the left groin. She required large doses of morphia during the night. The pain continued with increasing severity, accompanied by hard chills and frequent vomiting. After entering the hospital she had two severe chills and vomited several times.

Examination —A fairly well-developed and nourished young woman, somewhat anæmic, evidently very sick. Nothing abnormal found in the heart or lungs. The abdomen was everywhere extremely rigid and tender, the greatest amount of muscular spasm, however, was in the left hypochondrium. There was marked tenderness in the costo-vertebral angle on the left. Vaginal examination showed some tenderness and increased resistance on the left of the uterus, but no mass could be felt. The uterus was normal in size and freely movable. Temperature, 104° F. Pulse, 140, poor quality. Leucocytosis, 26,000. Examination of urine showed no pus, blood or albumin. Neither kidney could be palpated, but attempts to palpate the left kidney caused exquisite tenderness anteriorly and posteriorly. While the symptoms and signs pointed with definiteness to an acute abdominal infection, probably gastric perforation, the marked tenderness in the costo-vertebral angle made me consider an infected kidney, yet because of the positive abdominal signs and the absence of blood and pus in the urine it seemed wise to make an anterior incision first.

A short incision through the left rectus muscle above the umbilicus was made and the abdominal cavity opened. There was no evidence of peritoneal infection. The right kidney was normal in size and position. The left kidney was found to be enlarged and the perirenal tissue œdematous. The anterior wound was rapidly closed and the left kidney cut down upon through an incision in the flank. It was covered with characteristic small dark and yellow spots, the multiple septic infarcts. The kidney was removed, the renal vessels having been tied with silk. A gauze drain was left in and the wound closed about it with chromicized catgut and silkworm gut. One pint of salt solution was given intravenously before the patient left the operating room.

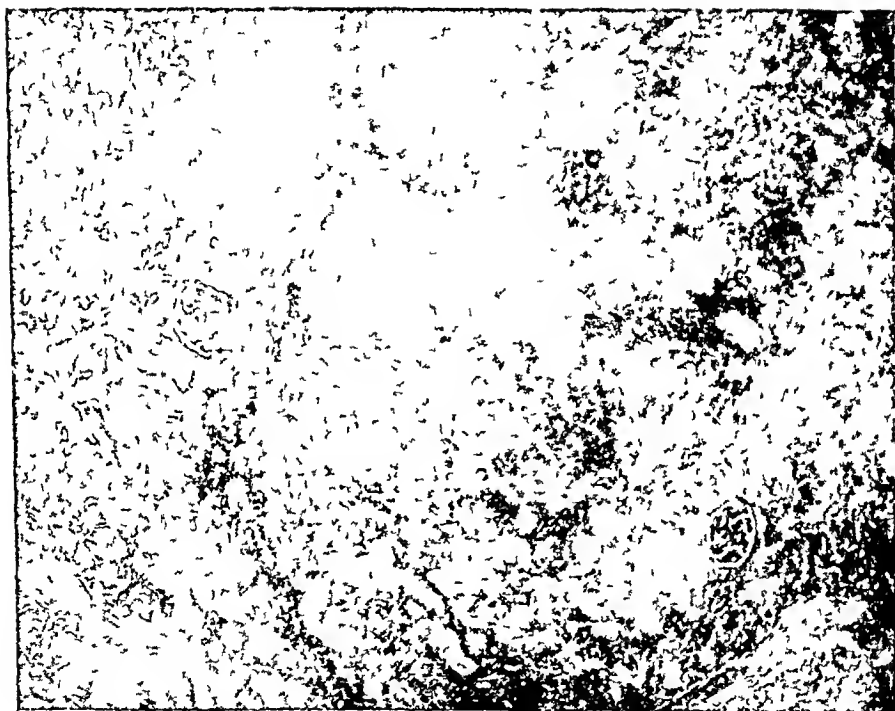
The patient made a prompt and satisfactory recovery. Twenty-four hours after the operation the temperature had dropped to 100° F and the leucocyte count to 16,000. Three days after the operation the temperature was normal and the leucocyte count 7000. The wound drained a large amount of rather foul pus for two weeks, after which it healed without incident. The other kidney performed its functions perfectly,

FIG 1



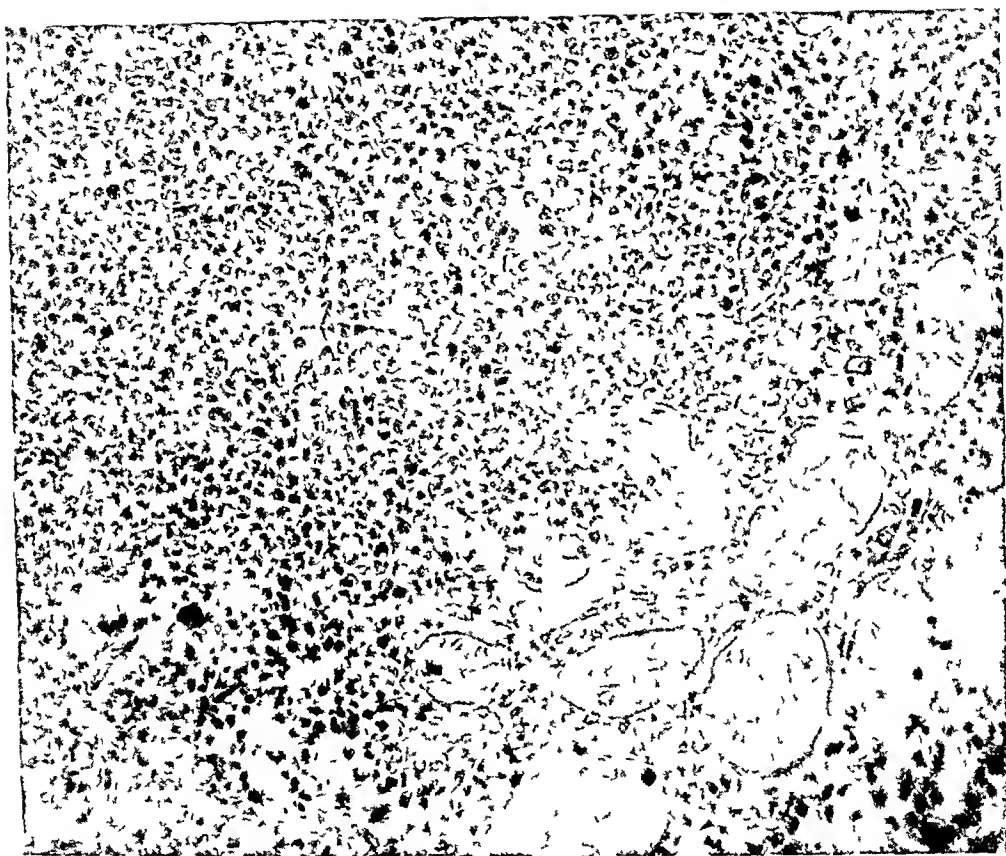
Acute case simulating gastric perforation Operation 26 hours after first symptoms Figs 2
and 3 are sections through one of the infarcts in this kidney (Specimen from Case I)

FIG 2



Acute septic infarct in cortex under low power (Section from kidney shown in Fig 1)

FIG 3



Border of the same infarct under high power Note beginning disintegration of one of the tubules

at no time was there active or passive congestion The cultures from the infarcts showed pure colon bacillus infection

This patient has remained well The appearance of the infected kidney in this case is shown in Fig 1, and in Figs 2 and 3 are shown microscopic sections from one of the infarcts under high and low power

The chief points of interest in this important condition are the cause, the source and kind of infection and the diagnosis Some abnormality in the kidney or ureter is the probable cause of the arrest of the bacteria The infecting bacteria are almost always arrested in the terminal vessels of the cortex close to the fibrous capsule The blood vessels become choked with microorganisms Blood passes into the interstitial tissues and in this stage of infiltration, the earliest stage, the infected areas resemble true hemorrhagic infarcts As the infection goes on a true abscess is formed, separated from the sound tissue by a hemorrhagic margin The infected areas then resemble minute pus points or septic infarcts The condition has been aptly named by Dr Whitney, Surgical Pathologist to the Massachusetts General Hospital, "*focal suppurative nephritis*" (Figs 1, 4 and 5 show remarkably well the appearance of the infarcts in various stages)

The following paragraphs on the etiology and pathology as far as the heading "Diagnosis" are with certain modifications taken from my previous article

The kidney can be infected through the blood by a variety of organisms Infection carried by true emboli would be the same infection as the focus from which the emboli started The common microorganisms of pus, the streptococcus and staphylococcus, the typhoid bacillus, Friedlander's diplococcus, the bacillus of diphtheria, the bacillus pyocyaneus and the pneumococcus have all been isolated from renal abscesses The most frequent infections are undoubtedly due to the colon bacillus and to pus organisms It is to be emphasized that the colon bacillus causes by far the greatest number of infections and that these infections are usually pure infections, this is

true no matter whether the source is the blood or the urinary channels

No mention will be made in this paper of infection of the kidney through the blood by tubercle bacilli. The subject of tuberculosis of the kidney is one that demands special consideration. Infection by the gonococcus is seldom, if ever, a pure infection, and so far as is known is always the ascending form and not an infection through the blood. Herszky, however, states that while gonococcus infection of the kidney is an ascending infection and usually mixed, he can refer to a few cases of renal abscess in which the specific organisms of gonorrhœa were found which probably came from the blood. Le Fur has reported a case of probable hæmatogenous infection by the gonococcus.

Until recently it was thought that when large numbers of bacteria were in the blood, whether through general septicæmia or in some diseases, as diphtheria, or experimentally by injection into the veins or peritoneal cavity, most of the bacteria passed through the kidneys and were eliminated by the urine, and that the chance of disturbing the functions of the kidneys was great. Recent experimental research, however, seems to prove that the majority of the organisms introduced into the circulation are destroyed before reaching the kidneys, and that while many bacteria are eliminated by the urine it is unusual for bacteria to lodge in the kidney if the kidney and ureter are normal. The researches of Buxton and Torrey in the laboratory of experimental pathology of Cornell University, as well as the work of Metchnikoff and Canon, seem to prove this absolutely. It is doubtless true that one of the functions of the kidney is to excrete bacteria which have gained access to the circulating blood and have not become destroyed before reaching the kidney. Microorganisms may be excreted by the kidneys without injuring them in any way. The finding of bacteria in the urine, as in typhoid fever, does not necessarily mean renal infection, only that certain of the bacteria from the general disease or from distant septic foci have passed through the kidneys.

Sampson, of Johns Hopkins, performed a series of experiments on dogs in which he tied the ureter of one kidney and injected pure cultures of staphylococcus into the jugular vein. He found that bacteria were eliminated to a certain extent by the urine, but only in those cases in which he tied the ureter did the kidney become infected. Brewer, later in a series of experiments on dogs, found that not only obstructing the ureter but bruising the kidney caused infection.

The colon bacillus is the most frequent form of urinary infection, whether of the kidney or of the bladder. It is now well known that the colon bacillus, under certain conditions, has virulent pathogenic properties, that it is a true pyogenic organism. The intestinal canal, particularly the lower intestine, swarms with different varieties of this bacillus. Under normal conditions of the intestinal mucous membrane the intestines do not absorb the bacillus or its toxins, but it is known that when a break in the intestinal mucous membrane occurs, and also in severe and long continued constipation, the bacteria pass through the intestinal walls in large numbers. Therefore, as an explanation of the source of infection in persons in previous good health, it may be fairly stated that not infrequently in the life of an individual the blood is infected by quantities of colon bacilli, which have been taken up because of some slight defect in the lining epithelium of the intestinal canal, or during an attack of obstinate constipation. Whether these infections result in pathologic conditions elsewhere will depend largely upon the general good health of the individual and upon the conditions of the various organs in the body.

The bladder, prostate gland and the uterus and its adnexa are additional possible sources of bacterial infection of the kidney through the blood. The blood vessels of the kidney communicate with those of the bladder, aside from the general circulation, through two other channels, the utero-ovarian and the vessels of the ureter itself. By injection experiments Sampson demonstrated that free arterial anastomosis exists between the branches of the renal artery supplying the capsule of the kidney about its lower pole, the kidney and the branches

of the ovarian artery The ovarian artery anastomoses freely with the uterine and with the vesical There is both venous and arterial communication Attention should also be called to the fact that the lymphatics, especially the glands, may act as intermediary channels between the primary focus in the bladder and the general circulation The lymphatic communication through the bladder to the kidney is indirect through the local glands of the bladder It is, therefore, an anatomical possibility for an ulceration or septic focus in the bladder, uterus or its adnexa to infect the kidney by way of the general circulation or through anastomotic channels directly It is doubtful whether direct infection through the blood vessels of the ureter ever occurs

The infection in all the cases reported in this paper was *colon bacillus* The work of Sampson, Buxton and Torrey and Brewer has proved that in normal conditions of health and normal kidneys bacteria will pass through the kidney without causing harm, that some abnormality in the kidney or its ureter is the reason for the arrest of the bacteria The kidney may have been injured by a fall or blow upon the loin Two cases from the records of the Massachusetts General Hospital have a history of blow over the kidney from four weeks to two months before the infection The kidney may be prolapsed or rotated on its axis so that its circulation is deranged. Small stones are in my opinion a not infrequent cause of these infections This series of cases furnishes some information in regard to the influence of calculi In two of my acute cases small stones were found embedded in one of the calices, in one a very small calculus on the floor of the bladder was discovered by the cystoscope, in a fourth case a nephrectomy for stone had been done a year previously (see Cases I, III, V, VI, VIII) In all probability a frequent cause is an abnormality of the ureter due to stricture, the result of inflammation or calculi, in women deformities in the ureter caused by pregnancy or childbirth It can not be stated, however, that such infections never take place in lowered general vitality with or without abnormalities in the kidney or its ureter Infection,

so far as known, usually comes from the intestinal canal, although it may come from the reproductive organs and lower urinary tract in the female, especially in those cases where old pelvic disease with intestinal adhesions is present

Diagnosis—In the acute fulminating cases there may be nothing pointing to the kidney except tenderness in the costo-vertebral angle,—this I have found to be a constant sign. These acute cases present an exact picture of an acute abdominal infection,—sudden abdominal pain, tenderness, muscular spasm, vomiting, high temperature, pulse and leucocyte count. In such cases, unless blood and blood casts, with or without pus, are found in the urine, or an enlarged and tender kidney can be palpated, a positive diagnosis cannot be made. In the presence of septic conditions elsewhere or in general infectious diseases such an acute picture should always lead to a consideration of acute infection of the kidney. Fortunately the majority of the cases furnish some positive evidence either in the urine examination or by palpation of the kidney. In the less acutely sick cases the condition of both kidneys should be studied by ureteral catheterization and X-ray. In all but two of the cases reported here there was some sign which pointed directly to the kidney, and time could be taken for cystoscopy and X-ray. In certain of the cases the pain may be referred entirely to the region of the appendix or gall-bladder. In Case I the symptoms and signs were exactly those of duodenal or gastric perforation, in Case VII of appendicitis. The examination of the abdomen may give all degrees of tenderness and muscle spasm. Leucocytosis is always high in the acute cases, 18,000 to 36,000. The differential diagnosis in the acute cases, unless the kidney is enlarged and tender or the urine shows blood and blood casts and pus, will always be difficult if not impossible. It is the writer's opinion that in acute cases in which positive evidence of the kidney cannot be obtained, it is better to make a preliminary anterior incision to settle the diagnosis and the existence of the other kidney as quickly as possible. Delay even long enough for ureteral catheterization may be dangerous.

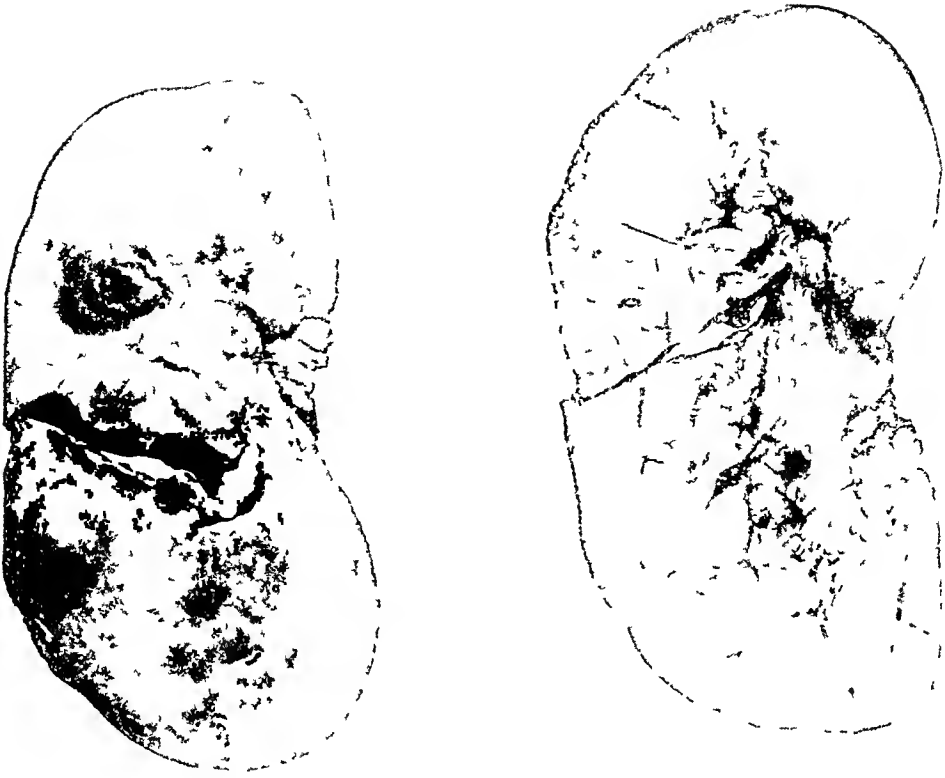
The presence of albumin, pus and blood in the urine, associated with tenderness in the costo-vertebral angle and a high white blood count should point to the kidney as the cause of the acute symptoms in persons previously in apparent good health. There should be little difficulty in diagnosis if in addition to the signs and symptoms just mentioned an enlarged and tender kidney can be felt. In the exceptional fulminating cases where nothing is found by palpation or in the urine, especially when the right kidney is infected, a positive differential diagnosis cannot be made without operation.

In all but two of the cases the urine showed albumin, pus and blood. The blood was microscopic in all the cases. Brewer states that all but two out of thirteen of his cases showed pus and blood in the urine and in one case there was enough blood to color the urine. This large amount of blood I have never seen.

Case I, reported above is an illustration of the fulminating cases in which no positive diagnosis can be made without operation. The following is an example of the cases that are less acute in onset and in which definite signs pointing to the kidney can be found and a diagnosis made with a fair degree of accuracy.

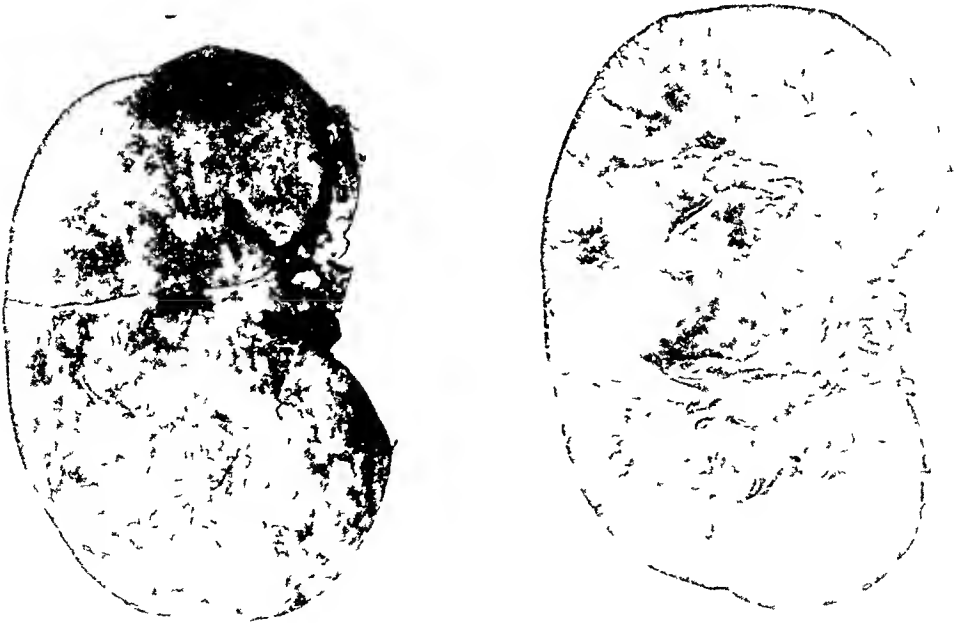
CASE II (*Operated upon 16 days after the first symptoms. Right kidney removed. Infection colon bacillus*) Mrs M E S, 34 years old, married, white, entered the hospital October 21, 1907. This patient was never strong. In the last fifteen years she had been operated upon three times for tuberculous glands in the neck and axilla. The last operation was in March, 1900. She had had one child seven years ago. Five years ago she had a miscarriage. Three weeks before admission she again miscarried and was curetted at another hospital, but was up and about at the end of a week and considered herself in better health and strength than for two or three years. Five days before admission she was awakened at night with a severe pain in the region of the appendix. She called her own physician, who told her that her temperature then was 103° F and the pulse 110. During the following week the pain gradually subsided and her general condition improved, although she remained in bed.

FIG 4



Operation 16 days after first symptoms Compare size of infarcts with those in Figs 1 and 5
(Specimen from Case 11)

FIG 5



Acute case simulating appendicitis Operation 4 days after first symptoms (Kidney from Case VII)

Examination—Thin, poorly nourished woman Temperature on the day of entrance was 101° F and it varied between that point and 99° F until the acute attack six days afterward Pulse 110, fair strength On each side of the neck were healed scars One or two small glands could be felt above the clavicles The left kidney could not be palpated The right kidney was distinctly enlarged and movable and slightly tender Nothing abnormal was found in the abdomen No tenderness or muscle spasm could be made out *at this time*. Vaginal examination found nothing abnormal X-ray plates of both kidneys showed no shadow of stone Cystoscopy and ureteral catheterization by Dr Lincoln Davis^{*} showed nothing pathological in the urine from either kidney *at this time* Because of the tubercular history and the large kidney with the pain on the right side, a probable diagnosis of renal tuberculosis was made, although special examinations of the urine gave no evidence of it Six days after entering the hospital the patient had a sudden severe attack of pain on the right side with a temperature of 104° F and a pulse of 120 The pain persisted and the high temperature was accompanied by chills The leucocyte count was 10,500 The right kidney was at that time very tender on palpation Ureteral catheterization then showed that the urine from the right kidney contained pus, blood and swarms of bacilli There was tenderness in the costo-vertebral angle

Operation by Dr Conant on October 31, 10 days after entering the hospital, 16 days after the first attack of pain in the right side, and 3 days after the acute attack, with positive signs in the urine and a markedly tender kidney Through an incision in the flank the right kidney was removed A gauze drain was left in The kidney showed typical foci of infection of various sizes (Fig 4)

Patient made a good recovery At no time did the temperature rise above 100° F The remaining kidney performed its functions with entire satisfaction The gauze drain was removed on the fifth day The patient left the hospital on February 27 The wound was healed and she was apparently in excellent general condition

*I desire to thank Dr Davis for his kindness in cystoscopy for me a number of the cases

It is probable that some of the cases, especially those less acute in onset may recover without operation. We can regard this as a reasonable theory in view of the clinical history of a few of the reported cases associated with the appearance of the kidneys at operation.

The number and size of the infarcts and the virulence of the infecting bacteria in relation to the resistance of the individual must determine the healing or activity of the foci. The degree of toxæmia depends also on the same factors. So also it is reasonable to suppose that such attacks may recur and may vary in intensity. Cases III, V and VI in the article bear out this line of thought. Case VI gave a history of recurring attacks of pain of moderate severity covering a period of years with symptoms similar but much less severe than in the last attack, for which I removed the kidney eight days after the onset. The organ showed numerous superficial scars presumably of healed infarcts in addition to many fresh septic infarcts of varying size, one of which contained over a dram of pus (see Fig 6).

It has been stated earlier in the paper that in the acute cases the course of the disease may be rapid with alarming and increasing toxæmia, or after the acute onset the patient may go for weeks or months in a septic condition while the infarcts become abscesses of various sizes. Do the fulminating and extremely toxic cases, similar to Case I, ever recover from an attack without operation? In the opinion of a few observers they do. It is impossible to say which cases may recover and which may not. In the acute cases operation must be governed by the severity of the toxic symptoms associated with the signs. Delay in operating, especially in those fulminating cases in which diagnosis is doubtful, cannot be justifiable. Delay for reasonable study and observation in the subacute cases will always be wise. The following case is an illustration of the fact that even the most acute cases may recover without operation. This case also illustrates the probability of recurrent attacks where some abnormality in the kidney or ureter favors. In view of the history and the

conditions found at the operation it seems rational to assume that the following case was one of acute infection of the right kidney, although absolute proof is lacking

CASE III. (*Acute case simulating a grave abdominal emergency Two operations, the first under a diagnosis of appendicitis*) Mrs G S, 23 years old, married, mulatto, entered the hospital December 22, 1906 With the exception of typhoid fever two years before had always been well Had had no children Four days before admission to the hospital began to have pain in the right upper quadrant of the abdomen running through into the back Pain only moderately severe and not accompanied by vomiting or urinary symptoms

Examination —Abdomen slightly tender on the right No spasm, no mass Vaginal examination negative Temperature 99° F Pulse 110 Twenty-four hours after entrance pain increased in severity Temperature rose to 103° F and pulse to 120 Leucocyte count at this time 9000 There was then some general tenderness in the abdomen and slight muscle spasm on the right Urine examination negative Next day temperature fell to normal Operation three days after entrance under a diagnosis of subacute appendicitis At operation nothing found to account for symptoms The appendix was removed but showed practically no signs of inflammation The kidney was not examined For a week following operation some pain and fever continued Patient left the hospital apparently well two weeks after the operation

Two months from the beginning of the first attack the patient reentered the hospital through the accident room After leaving the hospital she had been well until four days before when she began to have severe pain in the right side of the abdomen and frequent vomiting She had chills and high fever

Examination —She was evidently a very sick woman The abdomen was generally tender and rigid but the muscle spasm was most marked on the right side Temperature, 105° F Pulse, 140, and of poor quality There was tenderness in the right costo-vertebral angle White blood count was 25,000 Urine examination found albumin, pus and blood, with granular casts and blood casts Probable diagnosis of acute kidney made, but a preliminary incision through the right rectus muscle was made

to make the diagnosis certain and settle the presence of another kidney. There was no sign of abdominal infection. The right kidney was felt to be markedly enlarged and the perirenal tissues œdematous. There was a slight amount of intraperitoneal fluid between the ascending colon and the enlarged kidney. Cultures from this were sterile. The abdominal wound was rapidly closed, but before this could be done the patient's condition became so serious that no further operation at that time could be considered. She was almost pulseless and required intravenous salt solution and vigorous stimulation on the operating table. She was sent to the ward with the intention of cutting down upon the diseased kidney later if her condition justified it. No second operation was done because of the marked improvement in all the symptoms. The temperature gradually fell and reached normal on the ninth day while the general condition improved. The pus and blood rapidly disappeared from the urine and on December 3 it was normal. The white blood count remained between 18,000 and 27,000 for the first week and then became normal.

Four weeks after operation the patient passed without pain a small calculus about one-sixth of the size of a pea. X-ray photographs thereafter gave no shadow of stone.

I have seen this case at intervals. She has been free from any acute attacks, but complains of more or less constant pain in the right side. Urine examination has showed nothing pathological.

Treatment — This should always be by operation, even in the presence of severe sepsis. Recovery will be the rule if operation is not delayed too long. In the majority of reported cases nephrectomy has been the operation of choice. In three or four cases drainage of the infarcts with rubber tubes or gauze wicking has been successful. In two of my own cases this method of drainage was chosen, both cases recovered. One remained well but in the other case it was necessary to do a nephrectomy subsequently because of stone (see Case V). In very toxic cases in which the areas of infarction are numerous so that the function of the kidney is seriously interfered with nephrectomy must always be done. In cases where the

infarcts are limited in number and the general condition of the patient is good, the operation of splitting the capsule and draining the infarcts may be considered, but it should be borne in mind that subsequently the patient may have a recurrence of the infection or a renal stone

The method of operation should be determined upon in each case at the time. Should there be any doubt in regard to the presence and integrity of the other kidney, the simpler operation of incision and drainage should be adopted as a matter of course

Unless the abdominal cavity has been opened for some reason, either to settle an uncertain diagnosis or through error, the incision should be the usual one in the flank from the twelfth rib to and along the crest of the ileum. The question of whether it is safe, because of the danger of peritoneal infection, to remove the kidney through the anterior incision, has been raised by the operation of Dr Harrington in Case VII. He is the only surgeon who has had the courage to remove one of these acutely infected kidneys by the transperitoneal route. The method of all other surgeons has been that adopted by me in Case I.—first closing the anterior incision, then taking out the kidney through an incision in the flank because of the fear of septic peritonitis

The septic foci are directly under the fibrous capsule. The uncertainty as to whether manipulation of the kidney in its removal will break into one or more of the infarcts and the uncertainty also of the stage and virulence of the infection, must decide that there is greater safety in the posterior method, on the other hand, the increased time and added shock of the operation through a second incision are to be taken into account. In my opinion, if the patient's condition justifies the extra time, it is better to remove the kidney through the posterior incision than to take any risk of peritonitis, but in those cases that are too sick for such a prolonged operation, if an anterior incision has been made for any reason, the kidney should be removed through this first incision rather than left
in situ

CASE V (*Recurrent attacks of pain in the left kidney First operation 3 weeks after first attack Kidney decapsulated and infarcts drained Seven months later same kidney removed*) Mrs C A H, 44 years old, married, white, entered the hospital December 14, 1907 She had had seven children and two miscarriages For four years had had recurring attacks of pain in the left side associated with vomiting, frequent micturition and sometimes retention of urine, especially when the pain was most severe Pain had been general over the abdomen, but also in the back and into the left groin

I first saw this patient in the Out-Patient Department of the hospital, where a provisional diagnosis of renal calculus was made Examination at this time found no abdominal tenderness or muscle spasm Both kidneys could be palpated, the left was larger than the right and tender Vaginal examination found nothing abnormal Heart and lungs were normal X-ray plates gave no evidence of stone Urine from both kidneys examined separately and nothing abnormal found After entering the hospital the patient had a marked attack of pain with some rise in temperature Although the X-ray was negative the symptoms demanded exploration of the kidney and the diagnosis at this time was renal or ureteral calculus No consideration was given to a diagnosis of septic infarcts

Operated on May 9, 1907 The left kidney was cut down upon through an incision in the flank The fatty capsule was adherent On exposing the kidney it was found to be enlarged with its anterior pole firmly adherent, so that attempts to deliver it were resisted The surface of the kidney was covered with old scars and also showed a number of areas of infarcts similar to those in Case IV The capsule was split and the softened areas drained as in the preceding case The wound was closed around a cigarette drain which was removed four days after the operation Two weeks after the operation it was necessary to reopen the wound for a collection of pus, after which convalescence was uneventful On June 28 she left the hospital with a small discharging sinus This sinus remained open for two months After its closure she had continued pain over the abdomen, especially on the left side It was mainly in front, but ran through into the back and was accompanied with frequent and painful

FIG 6



Nephrectomy 8 days after onset. Large abscess in central portion, smaller abscesses near the poles. (Specimen from Case VI.)

FIG 7



First operation, decapsulation and drainage. Second operation, nephrectomy (7 months later). Stone embedded in one of the calyces. (Specimen from Case V.)

micturition Her general health was good During the attacks of pain there was nausea and occasional vomiting

She reentered the hospital for these severe attacks of pain December 14, approximately seven months after the first operation Examination at this time found some muscle spasm with tenderness on the left side of the abdomen The kidney could be palpated and deep pressure over it from the front brought on severe attacks of pain simulating renal colic While under observation for a week the patient had severe attacks typical of renal colic Leucocytosis, 8000 Ureteral catheterization furnished no positive evidence of stone in the left kidney At this operation, because of its diseased and scarred appearance and the apparent remains of old infarcts, the left kidney was removed with considerable difficulty A cigarette drain was left in Upon splitting the kidney after its removal no stone could be found To discover a possible stone without cutting it into many pieces an X-ray of the organ was taken which showed the stone plainly The surface of the kidney was covered with pitted scars of the old infarcts At the upper pole was a collection of grumous material like a small hemorrhagic cyst just under the capsule A small stone was found embedded in one of the calices (The appearance of the kidney and the stone are shown in Fig 7)

This case furnishes some evidence that small stones may be the cause of bacterial localization and also suggests that a certain number of these cases may have recurring bacterial infarcts The recovery from the second operation was uneventful and the patient was seen several months after the operation She was free from all pain and was in good health

CASE VI (*Acute case with history suggestive of previous less acute attacks Operated upon 11 days after the first symptoms Infection colon bacillus.*) Mrs F L, 48 years old, married, white, entered the hospital through the accident room on the evening of November 10, 1907 Had had several children For 16 years had had occasional attacks of pain in the left side of the abdomen and back, somewhat similar to the pain during present acute attack, but not nearly so severe These attacks had come two or three times a year and during them micturition had occasionally been painful and frequent There has been no hæmaturia and she has never passed a stone Bowels always very constipated Seven days before admission was taken with sud-

den intense pain in the left side of the abdomen running into the back and left leg, so severe that she had to be etherized by her physician. She had chills and vomited. After acute onset pain persisted but was less severe. At the onset had difficulty in passing urine, but this only lasted a short time.

Examination —Rather poorly nourished and developed woman, apparently very sick. Tongue coated and dry. Temperature, 100° F. Pulse, 112, and poor. Heart signs weak, no murmurs. Over the left abdomen, especially in the upper quadrant, there was tenderness and muscle spasm. There was tenderness in the costo-vertebral angle and the left kidney could be made out vaguely by palpation, although attempts to do so caused great pain. Vaginal examination found signs of old pelvic inflammation. X-ray plates showed no shadow of stone. Cystoscopy by Dr. Davis showed normal urine from the right kidney, but purulent urine from the left, and on the floor of the bladder was seen a very small calculus. Four days after entrance the left kidney was removed through an incision in the flank. It was enlarged and contained in the central portion an abscess cavity holding two drams of thin greenish pus and in addition small septic infarcts throughout the cortical substance. Cultures from the abscess and from the small infarcts gave pure colon bacillus infection. This patient made a satisfactory recovery and gained weight and strength rapidly after the operation and left the hospital well on December 17, 1907, about five weeks after admission. (This kidney is shown in Fig. 6.)

CASE VII (Acute fulminating case. Diagnosis of acute appendicitis. Operation 4 days after first symptoms. Infection colon bacillus) Mrs. M. B., 25 years old, married, white, entered the accident room on the morning of January 9, 1908. She had had a similar attack three months before. Four days previous she was taken with a pain in the right side of the abdomen and vomiting. Symptoms typical of acute appendicitis had persisted. Bowels had moved daily.

Examination —Evidently very sick patient. Nothing abnormal in the chest. In the right side of the abdomen was tenderness and marked muscle spasm and a mass extending well backward into the flank and down as far as McBurney's point. This mass was tender and resembled an appendix cake. Urine examination showed no blood. No leucocyte count recorded.

Operation by Dr Harrington three hours after admission. Anterior incision in appendix region. There was no evidence of appendicitis or peritoneal infection. The right kidney was enlarged. This was removed *through the anterior incision*. The abdominal wound was closed in layers, a cigarette drain being left in. The kidney showed numerous typical infarcts. Convalescence in this case was uninterrupted and satisfactory. On January 27, three weeks after the operation, the wound had healed solidly and the patient was discharged from the hospital apparently well with normal urine. (The appearance of the kidney is shown in Fig 5.) As stated above, this is the only reported case in which nephrectomy was done through the anterior incision.

CASE VIII (*Subacute case Operation 3 weeks after first symptoms Previous operation for stone*) George H., single, 28 years old, white, entered the hospital December 24 1907. A large stone had been removed from his right kidney about a year previously. He recovered well from this operation and had no further trouble until three weeks before his reentry when he began to notice blood in the urine and began to have attacks of pain in the right side and back similar to those he had before his first operation. For a week the urine had been noticeably bloody.

Examination—Well developed and nourished man. Nothing unusual made out on physical examination except marked tenderness on the right side of the abdomen. There was some muscle spasm, also tenderness over the scar in the flank. The kidney could not be palpated. Urine examination showed albumin, pus and microscopic blood. X-ray examination showed positive shadows of stone. Accordingly Dr Conant operated for stone on the 26th of December. The kidney was somewhat bound down by old adhesions, but on inspection was found to show typical areas of septic infarcts. After ascertaining the existence of the other kidney by examination across the peritoneum, the diseased kidney was removed and a gauze drain left in. An examination of the kidney after its removal showed no stone. This case recovered satisfactorily with the exception of a persistent colon infection of the bladder, which so far has yielded to no treatment.

BIBLIOGRAPHY

- Albarran, J, Assoc franç d'urol Proc Verb, 1904, Par, 1905, viii, 719, Cong Soc Internat de Chir Rap Bruv, 1905, i, No 6, 1
- Bazy, Bull et Mem Soc. de Chir de Paris, 1903, ii s, xxi, 101
- Barnard, Lancet, London, 1905, ii, 1243
- Block, Med Herald, St Joseph, 1905, n s, xiv, 384
- Brewer, G E, Trans N Y Surg Soc, Oct 26, Annals of Surgery, Dec, 1904, 1010, Surg Gynec and Obstet, May, 1906
- Buxton and Torrey, Jour Med Research, July, 1906, n s, x, No 1
- Cabot, A T, Boston Med and Surg Jour, June 6, 1901, cxli, No 23
- Cagnetto and Fessaro, Ziegler's Beiträge, 1904, xxi, hft 3, 536
- Cathelm, Ann d mal d org gen-urin, Paris, 1905, ii, 1065
- Cobb, F, Boston Med and Surg Jour, Jan 24, 1907, clvi, No 4, 97, Boston Med and Surg Jour, Feb 13, 1908, clviii, No 7, 226
- Councilman, Jour Amer Med Assoc, 1906, cli, 81
- Dobbertin, Charité Ann, Berlin, 1903, xxi, 306
- Dugan, Int Clinics, Phila, 1904, 13 s, iv, 200
- Gerster, Mt Sinai Hosp Reports, 1905, iv, 165
- Gibson, Med News, N Y, 1905, lxxvi, 435
- Herszky, Centralblatt f d Grenzgeb d Med u Chir, Jena, 1903, vi, 9, 49, 102
- Hessert, Annals of Surgery, 1905, cli, 792, Ill Med Jour, 1905, vii, 289
- Johnson, A B, Annals of Surgery, 1899, xxi
- Kaufmann, Med Woch, Berlin, 1903, iv, 441
- Kelley, Amer Jour of Obstet, 1904, l, 857
- LeFur, Assoc franç d'urol Proc Verb, 1904, Paris, 1905, viii, 753
- Lilienthal, Trans N Y Surg Soc, Oct 26, Annals of Surgery, Dec, 1904, 1010, Annals of Surgery, 1896, xliii
- McArthur, Medicine, March, 1901
- McCosh, A J, Trans N Y Surg Soc, Oct 26, Annals of Surgery, Dec, 1904, 1010
- McWilliams, C A, Med Rec, July 7, 1906, 7
- Metin, Ann de l'Institut Pasteur, 1900, No 6
- Pawlowsky, Zeitschr fur Hygiene und Infectious Krankheit, 1900, xxxiii, 261
- Peck, C H, Annals of Surgery, Oct, 1906
- Pels-Leusden, Verhandl d deut Gesellsch f Chir, Berlin, 1905, xxxiv, 61
- Pollard, Birmingham Med Rec, 1904, iv, 247
- Ransohoff, Jour Amer Med Assoc, 1903, xl, 1502
- Robinson, Amer Jour Surg and Gynec, St Louis, 1902-3, cvi, 97
- Sampson, Johns Hopkins Bull, Dec, 1903, 335
- Senator, Nothnagel, Specielle Pathologie und Therapie, vi, 1
- Sondern, Med News, N Y, 1905, lxxvi, 438
- Spence, Brooklyn Med Jour, 1904, xviii, 236
- Stevens, Glasgow Med Jour, 1884, 161
- Strohecker, Ill Med Jour, 1903-4, n s, v, 577
- Woolsey, G, Annals of Surgery, Oct, 1906
- Wright, Boston Med and Surg Jour, 1905, cli, 496

CONTRIBUTION TO RENAL AND URETERAL SURGERY.

BY DANIEL N. EISENDRATH, M.D.,

AND

MAXIMILIAN HERZOG, M.D.,

OF CHICAGO, ILL

I MULTIPLE URETERAL CALCULI COMPLICATED BY HYPOPLASIA OF OPPOSITE KIDNEY

THE following case is interesting, from first, the presence of an unusually large calculus in the vesical end of the right ureter, accompanied by a second calculus higher up on the same side which completely occluded this ureter. Second, a hypertrophy and septic condition of the right kidney whose ureter had been obstructed. Third, a hypoplasia of the opposite kidney. We thus have a congenital anomaly in the form of a hypoplasia of the left kidney associated with an acquired pathological condition in the shape of a right septic pyelonephritis in a hypertrophied organ.

The case is particularly instructive because it shows that occasionally, all of the modern methods of exploring the genito-urinary organs, including cystoscopy, catheterization of the ureters, cryoscopic and other determinations of the separately collected urines may fail, be misleading and eventually may cause surgical interference of a contraindicated character.

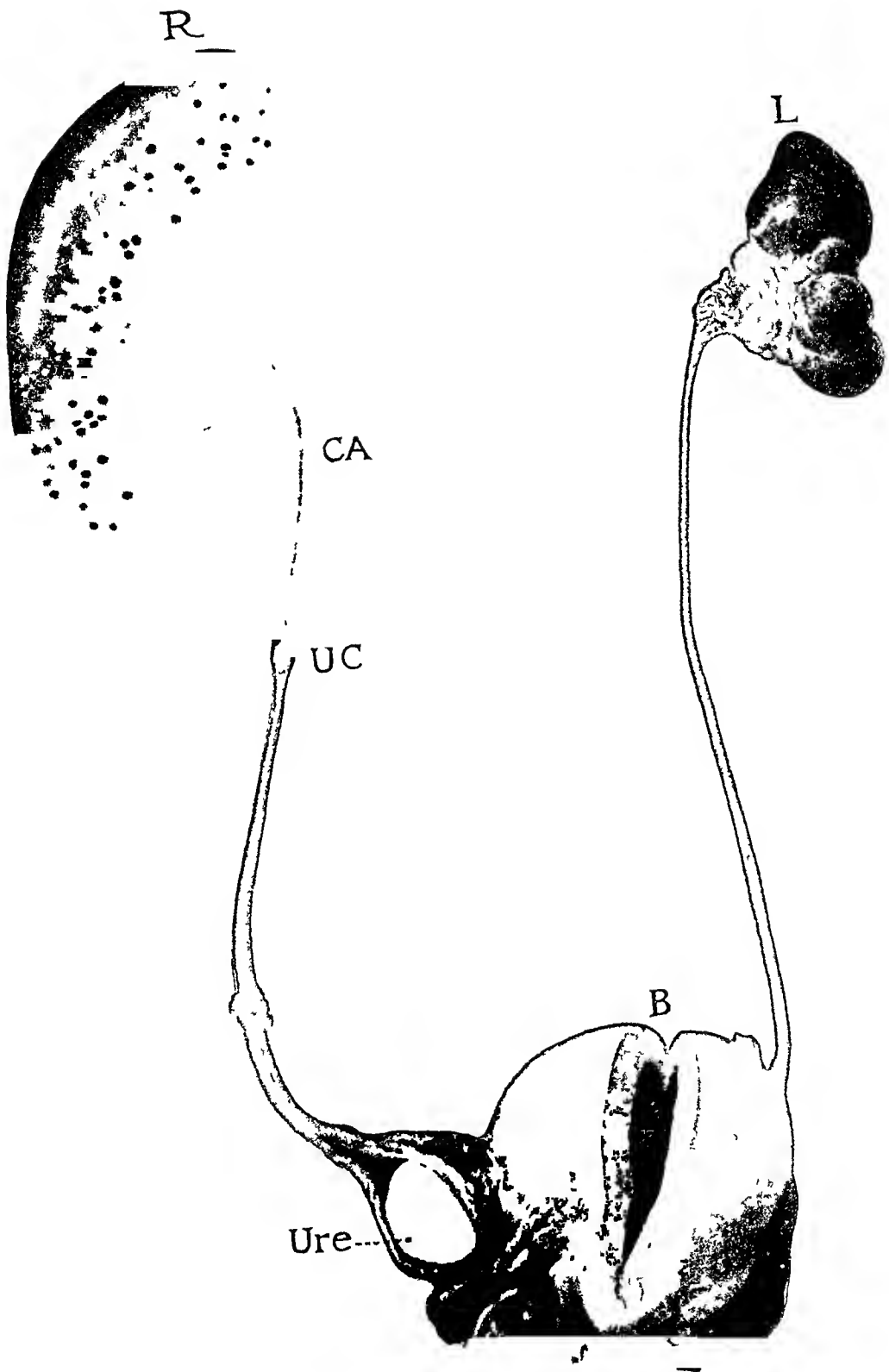
In the case to be reported, that of a man about 35 years old, there was found on post-mortem examination a right septic kidney with calculi weighing 276 gms. One of the calculi was situated in the kidney, one in the upper part of the ureter and one in the latter, just before its entrance into the bladder. It was obvious from the size and the situation of the latter calculus, that it would have prevented successful catheterization of the right ureter. The left kidney while presenting some pathologic changes was found in a condition enabling it

to still secrete a fairly normal urine free from pus, though perhaps containing some casts. But this kidney only weighed 39 gms after having been preserved in Kaiserling's fluid, and undoubtedly somewhat less when first removed during the autopsy. On an average the adult male possesses about 320 gms kidney-substance, the left kidney is generally somewhat (6-7 gms) heavier than the right one. Upon removal of the right diseased kidney, in our case, 39 gms of left kidney substance would not have been sufficient for the performance of the necessary urinary secretion.

The following is the clinical history of this case.

M. N., aged 34, clerk, was admitted to the Michael Reese Hospital to the service of Dr. Eisendrath on March 11, 1908, with the diagnosis of gall-stones. He had typhoid and pneumonia eight years before admission and had been under the care of a physician for five years for kidney trouble. He was taken sick three days before admission with pain in the right lumbar region and fever. These symptoms were accompanied by a gradually increasing stupor which changed to a coma shortly after admission. His temperature was 103, pulse 160, and respiration 40. The leucocyte count was 7000. Twenty ounces of urine were obtained by catheter during the first 30 hours. This urine contained 1 per cent urea, a trace of albumin and a few white and red corpuscles, but was otherwise negative. Examination soon after admission showed marked rigidity over the entire abdomen, but most marked over the right upper quadrant. There was apparent tenderness over the area of rigidity, but this was also most marked over the gall-bladder region. This rigidity and tenderness varied greatly in intensity during repeated examinations, so that in the absence of any abdominal distention, of vomiting and the fact that the bowels moved after enemas, it was decided to wait before performing an exploratory laparotomy. During the first 24 hours the following additional symptoms presented themselves: the pulse became more rapid and weaker, rising to 180, he was deeply comatose, rigidity of the neck and arms became marked, a Kernig sign was distinct and there was slight opisthotonos. During the second 24 hours he passed 12 ounces of urine of the same quality as on the previous day. Physical

FIG 1



Specimen removed at autopsy showing multiple calculi in right ureter R Greatly enlarged right kidney showing evidences of suppurative pyelonephritis CA Right ureter distended with blood and urine UC Ureteral calculus located just above a stricture of the ureter Ure Large faceted ureteral calculus located in distended vesical end of ureter B Bladder opened in median line L Undeveloped left kidney showing foetal lobulations

examination showed some dulness and bronchial breathing over the left lower lobe. The diagnosis of severe influenza with meningeal and pulmonary localization was made. The patient became deeply comatose and died on the third day after admission.

Report of Autopsy and Comments—The brain shows an intense congestion of the entire pia-arachnoid. This membrane is dull, but there is no visible pus. The hemispheres show numerous minute hemorrhages. The ventricles contain an increased amount of fluid and the choroid plexus is congested.

Pericardium and heart, normal except that the left ventricle is somewhat hypertrophic and that the pericardial fat is quite abundant. The beginning of the aorta shows a few small slight elevated atheromatous spots. Coronary vessels normal. The left lung is adherent to the pleura costalis at the lower portion of the lower lobe. This lobe and part of the upper lobe are completely consolidated and pieces taken from these parts sink in water. On section the consolidated areas appear mottled. On the whole the color is dark brown-red, but there are grayish portions here and there. A thick purulent bloody fluid can be squeezed out from the consolidated portions. The right lung is full of air, crepitant throughout presenting in fact a slight degree of compensatory emphysema. In a few places on the dependent surfaces patches of hypostatic congestion are found. Otherwise the right lung is normal.

Spleen considerably enlarged, capsule smooth, dark purplish brown. On section trabeculae distinct, follicles rather indistinct, pulp soft, easily scraped off.

Genito-urinary Organs—The left kidney is very small, irregularly lobulated, on the whole about the fourth of the bulk of a normal kidney. It weighs after having been preserved in Kaiserling's fluid 39 Gms. On section, this small kidney shows no clear differentiation into cortex and medulla, its pelvis is very small, the left ureter about $\frac{1}{2}$ the diameter of a normal one. Left kidney is surrounded by a mass of hypertrophic perinephritic fat. Right kidney is very large, measuring from pole to pole about 5.5 in and transversely about the middle of the pelvis over 3 inches. It weighs, after having been preserved in Kaiserling's fluid, 276 Gms. It is dark purplish-pink in color. Capsule smooth and shining, little grayish-white patches from pinhead to millet-sized are seen throughout the capsule. On section the cortex is found to be widened, pyramids injected, renal tissue generally congested, tubules grayish-yellow, dull. Small grayish-white areas are found dispersed throughout the renal tissue. Near the upper pole at the junction of the medulla and the cortex a stone of the size of a cherry-stone is found lying free in a smooth-walled cavity. The pelvis of the right kidney is large and the first portion of the ureter is conically enlarged so that at its exit from the pelvis the base of the cone has two to three times the diameter of a normal ureter. About 3 to 4

inches downward a conical-shaped stone is wedged tolerably firmly in the ureter, obliterating it completely. Just below the point where this stone is situated, the ureter is somewhat constricted, lower down it is uniformly enlarged again, until it reaches the bladder. Before entering the bladder, the ureter forms an ampulla which contains a whitish, rather soft stone, the size of a large walnut. The bladder itself is rather large its walls markedly hypertrophied. Mucosa congested. Prostate normal. *Liver* slightly congested, otherwise normal, gall-bladder contains about 50 to 60 cc of dark-green bile, no stones. Stomach and intestines negative.

Anatomical Diagnosis—Acute congestion of pia-arachnoid. Adhesions at base of dura mater. Consolidation (red hepatization) of the left lung, congenital hypoplasia of the left kidney, multiple metastatic bacterial emboli of the right kidney, calculi in the right kidney and right ureter. Chronic cystitis. General septicopyæmia.

Chemical and microscopic examination of the large soft stone in the lower portion of the ureter shows that it is mostly composed of triple phosphate of calcium. Cultures made at the postmortem examination of the heart's blood and from the consolidated areas of the lung developed cocci and a small bacillus, the latter, however, not the bacillus of influenza.

Histological Examination—Smears from the consolidated portion of the lung show desquamated alveolar epithelia, mono- and polynuclear leucocytes, erythrocytes, cocci and small bacilli.

Sections of the consolidated portions of the alveoli are filled with a cellular exudate composed of red and white blood-corpuscles and desquamated alveolar epithelia. The erythrocytes generally predominate. However, there are also some alveoli where the white corpuscles are much more numerous than the red ones. The inflammatory exudate in the alveoli contain many cocci, small and also large slender bacilli. The cocci are not of the type of the pneumococcus, but are staphylococci. In the interior of some of the red blood-corpuscles chromatophilic bodies are seen. Throughout the tissue of the *right kidney* are seen numerous foci with dense leucocytic infiltration and quite a few uriniferous tubules contain a purulent exudate. Cocci and bacilli are found both in the interstitial inflammatory foci as well as in the purulent material in the uriniferous tubules.

The small left kidney microscopically shows a differentiation into a cortex and a medulla which had not been distinctly visible on naked eye inspection. In the cortex are seen numerous glomeruli, some of them exhibit very marked thickening of the capsules of Bowman with beginning atrophy of the Malpighian tufts. Most of the glomeruli however are in a normal condition. Chronic interstitial changes are also seen in the medulla, here in some places the interstitial connective tissue between the tubules is markedly increased. On the whole, however, the interstitial changes are not very extensive. In other places both in the cortex and medulla small foci of mononuclear cells are observed, among the latter are likewise found quite a number of polynuclear eosino-

FIG. 2



Skiagraph obtained by placing specimen shown in Fig. 1 upon an X ray plate. The location of the ureteral calculus is well shown and the calculus located at the middle of the ureter is conical its pointed end projecting into the stricture. Several calculi are seen in the parenchyma of the right kidney. The faceted nature of the lower ureteral calculus is well shown.

philes The vessels of the small left kidney are generally congested The epithelia lining the uriniferous tubules are generally fairly normal, while some show cloudy swelling Hyaline casts are found here and there in the tubules Bacteria could not be found in the sections of the left kidney, so it appears that it does not contain any bacterial foci which are so numerous in the large right kidney Sections through the pia-arachnoid and the brain-tissue which show highly congested vessels likewise do not exhibit any bacterial invasion

REMARKS

1 It is rather unusual to have as large a ureteral calculus situated at the vesical end of the ureter as this case shows The calculus was in reality double, the two being faceted

2 The upper of the two ureteral calculi completely occludes the right ureter so that it is difficult to say whether the symptoms of this patient were due to calculous anuria or to the septic condition resulting from suppurative pyelonephritis, or, finally, whether the entire clinical picture was not due to a severe influenzal infection

The presence of pneumonia and of the condition of the meninges rather speak for some general infection From a surgical standpoint the case is especially interesting The X-ray prior to any operation upon this patient would, of course, have shown two calculi The case shows above all, the great necessity of making a careful determination of the functional capacity of the kidney before performing a nephrectomy

2 RENAL LIPOMA, "*ex vacuo*"

Lipoma of the kidney is quite rare and the renal tumors described as such are really to be divided into two separate groups, entirely different as to their etiology

True lipomata of the kidney according to Borst (Die Lehre von den Geschwuelsten 1, 141) are generally small, multiple, sharply defined, and situated subcapsularly or in the peripheral parts of the cortex, rarely in the medulla They probably take their origin from misplaced embryonal inclusion derived from and cut off from the perirenal fatty tissue Frequently these renal lipomata are found symmetrically in both kidneys In consequence of atrophy of the renal tissue we

encounter fatty tumors due to a considerable increase either of the fatty tissue at the hilus or of the perirenal adipose tissue. These hypertrophic lipomatous masses have been called, "lipome intranephritic" and "lipome perinephritic" by the French writers, and "kapsuläre Lipome" by the Germans.

In some cases of this kind there is found in place of the kidney a lump of fat, having the shape of the kidney and still containing small remnants of kidney-tissue. The hypertrophy of the adipose tissue generally arises from a pelvis containing renal stones. Borst gives it as his opinion that in all cases of hypertrophy of the hilus and perirenal fat the atrophy of the kidney-substance is the primary factor and it is not the proliferation of the adipose tissue which secondarily leads to pressure atrophy of renal tissue.

The following is a case representing a lipoma of the second group, namely one which was due to hypertrophy of the adipose tissue, the hypertrophy following atrophy of the kidney-substance in consequence of stones and inflammatory processes of long standing. The clinical history of this case is as follows.

The patient was 28 years of age, a conductor by occupation, and admitted in October, 1906, to the service of Dr. Eisendrath, in Cook County Hospital. The patient had been operated upon 11 years before admission on account of perinephritic abscess, since which time a sinus had persisted over the left renal region. This sinus was located in the left postaxillary line about midway between the left last rib and the crest of the ilium. It was impossible to pass a sound further in than about 3 inches. Prior to the operation a ureteral catheterization was performed by Dr. Louis E. Schmidt, who found that urine which was entirely normal in character escaped from the right ureteral catheter, whereas it was impossible to pass a catheter for about one inch above the vesical end of the left ureter. An incision was made on the left parallel to the last rib and the kidney region explored. There were a number of dense adhesions around what seemed to be the kidney, but it was impossible to detect any kidney-substance proper. After extensive manipulation, it was possible to free

FIG 3

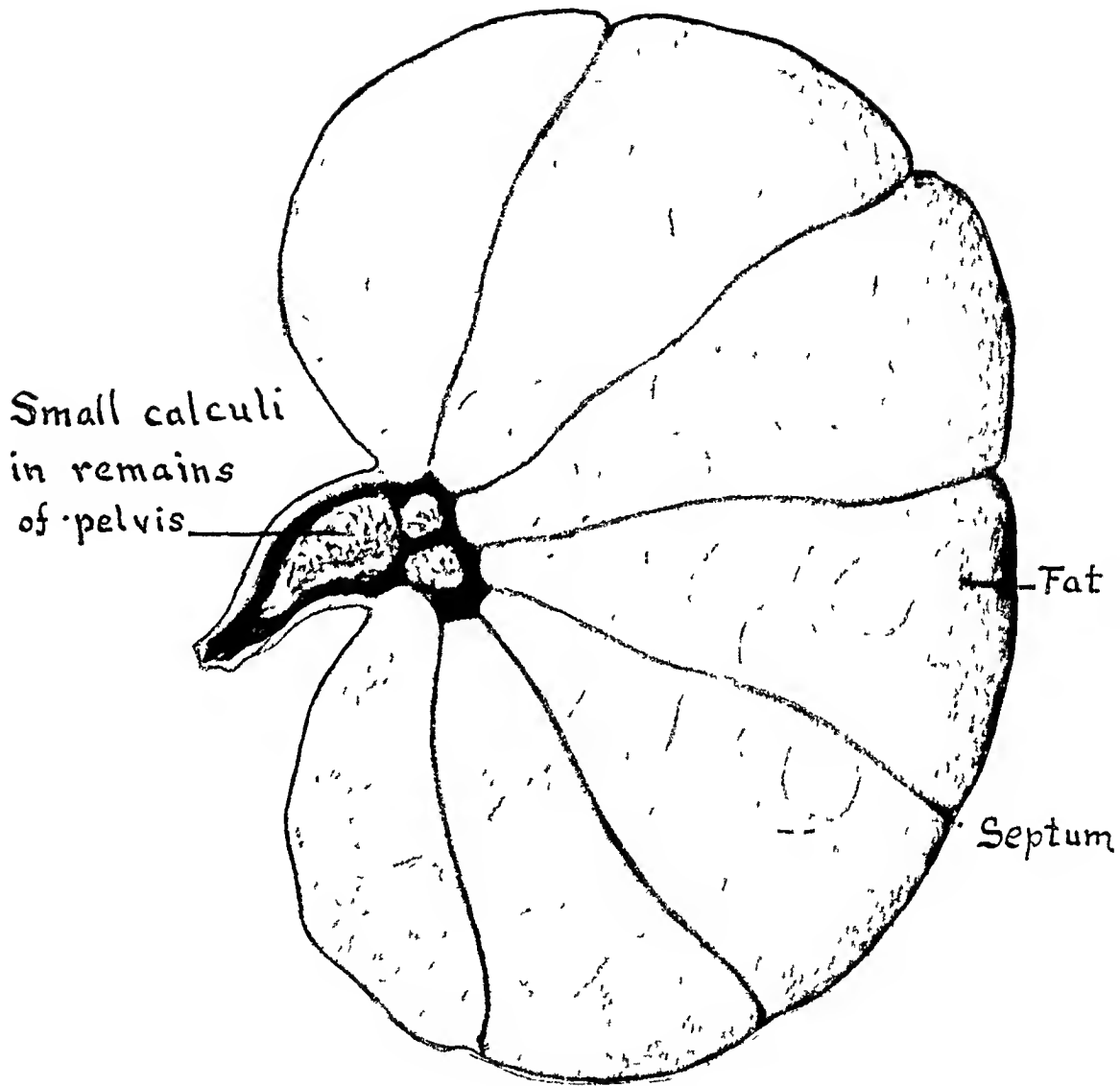


Illustration showing fatty transformation of kidney as a result of chronic suppuration following calculous pyelitis etc

what seemed to be a mass of fat, which had the shape of the kidney (Fig 3), but was somewhat smaller than an adult fist. Further examination showed that this mass had the shape of the normal kidney and was located in the position of the latter. In the freed specimen it was possible to identify several septa between the lobules of fat which corresponded to the septa between the original lobules of the kidney. The sinus itself led through this mass of fat into a dilatation which corresponded to the pelvis of the kidney and contained several small calculi. It was not necessary to ligate any vessels of the pedicle.

Microscopic examination of the mass removed showed it to be composed of loose areolar connective tissue, the meshes being filled with fat. The septa noticeable on naked-eye inspection were composed of coarse, more or less hyaline connective-tissue fibres. No remnants of any kidney-substance could be found in any of the sections examined. Apparently the renal tissue had disappeared and had in the course of time been completely displaced by the lipomatous mass.

We are dealing in this case with the type called "lipome intranephritic" by the French writers, because the renal septa still present demonstrate that the lipomatous mass proliferated right inside of the disappearing kidney-substance. It was also impossible to demonstrate any kidney-substance left. In perinephritic lipoma (as seen in such a case by one of us) there is generally a small mass of atrophic renal substance left which is placed like a small cap on the upper pole of the lipoma.

3 RUPTURE OF THE KIDNEY (Fig 4)

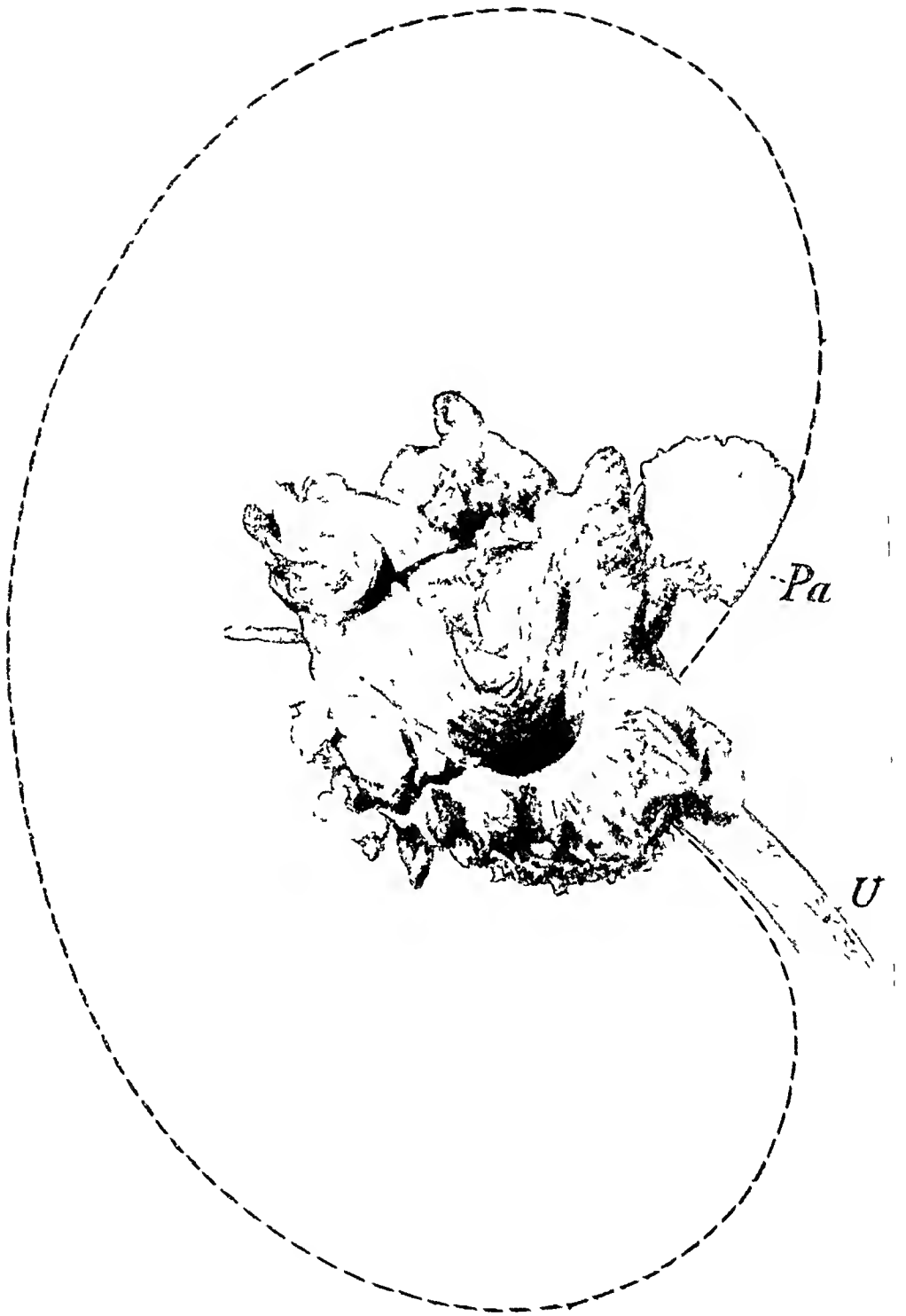
The following is an unusual case of rupture of the kidney, with subsequent infection and destruction of most of the mass of the injured kidney. A small remnant remaining continued to secrete a urinary fluid. This fact, however, is not at all surprising since we know quite well that parenchymatous organs even if their environments are changed or if transplanted keep on furnishing their normal secretions or excretions as long as they have a sufficient blood-supply and an adequate outlet for the products of their physiologic activity.

The clinical history of the case referred to is as follows

The patient was admitted to the service of another surgeon in the Cook County Hospital, January, 1906. He had been on a protracted spree and could give no history of the manner in which he received his injuries. He complained of pain in the right side of the abdomen and there was tenderness on pressure in the right hypochondriac region. The urine contained a large amount of blood. There were no external signs of injury, but the patient was suffering considerable shock. On January 8 patient seemed to be in more pain than during previous days. There was a moderate amount of tympany and hæmaturia continued to quite a marked degree.

On January 9 an exploratory operation was performed and the kidney exposed. A moderate amount of urinary infiltration was found around the kidney and a drain was inserted down to the pelvis of the kidney. Blood persisted in large quantities in the urine for a number of days after this operation. He was admitted to the service of Dr. Eisendrath May 10, 1906, on account of a urinary fistula situated about one inch below the last left rib in the midaxillary line at the centre of the former nephrotomy incision. A bloody watery fluid escaped mixed with pus. A probe was passed into the fistula downwards and inwards for about four inches. The former incision was reopened under anaesthesia and the finger at once entered a cavity containing about eight ounces of turbid fluid evidently urine. Finger upon being inserted into this cavity entered at once a structure which was readily recognized by those who examined him as the hilus of the kidney with the area extending downwards and inwards from it. Examination of the cavity showed that there was a portion of the kidney-tissue left along its anterior surface about the size of a walnut.

The kidney itself had probably been destroyed by the original injury or disintegrated by the subsequent infection. There was left in addition to this small fragment of parenchyma only the pelvis and the area extending from it (Fig 4). A sinus persisted for some months so that on July 20 it was necessary to reopen the wound and remove several small fragments of renal parenchyma which were adherent to the edge of the cavity and had evidently continued secreting. After this last operation patient made an uneventful recovery and wound healed.



Specimen from a case of complete rupture of the kidney Pa Remains of parenchyma
U Ureter with remnants of pelvis and calices attached

ARTHROPLASTY FOR COMPLETE ANKYLOSIS OF THE ELBOW.

RESULT ONE YEAR AND A HALF AFTER OPERATION

BY CHARLES L SCUDDER, M.D.,

OF BOSTON, MASS.,

Surgeon to the Massachusetts General Hospital, Lecturer on Surgery in
Harvard University

JANUARY 24, 1906 An adult male fell and sustained a T-fracture of the left elbow-joint, the internal condyle being displaced upward and forward When I saw this patient March 3, 1907, there was complete ankylosis of the elbow to flexion and extension The elbow was ankylosed at about 125° in extension. Supination was normal but pronation was considerably limited The accompanying X-ray photographs show well the lesion at the lower end of the humerus and the ankylosed condition of the joint at this time (See Fig 1)

It seemed wise to do an arthroplasty rather than an excision of the elbow for the reason that the latter often leaves the arm without the power of forcible extension Consequently a transverse section of the olecranon was made [Trendelenberg] to secure access to the old but obliterated joint surfaces A chisel separated the bony surfaces Sufficient bone was removed from the humerus and olecranon to fashion a fairly naturally shaped elbow-joint.

It was demonstrated, before considering the new joint well-fashioned, that normal motion existed in complete extension and flexion, with absolutely no impediment to a complete excursion Every vestige of synovial membrane was removed The new joint bony surfaces having been completed, a rectangular fascial fat flap (Murphy) was taken from the fascia overlying the triceps, far up the back of the upper arm This flap was transferred to the space between the bones forming the new elbow-joint The flap was pedicled just above the elbow-joint on the back of the upper arm The free margins of the flap were loosely caught to the peri-articular tissues to prevent dislodgement All bony

surfaces entering the new elbow-joint were completely covered by the flap. Plain No. 1 catgut sutures were used. The divided olecranon was sutured with aluminum bronze wire. The soft parts were closed tightly about the joint in two layers.

A removable internal angular splint was worn for some six weeks. Limited passive motion was begun less than two weeks following the operation. Very limited active and passive movements were encouraged after the second week, always avoiding pain to the joint which did not subside after a few moments' rest.

The active motion after a year and a half is seen in the figures. The joint is strong, it is most serviceable. When the joint is not actively engaged there is a distinct laxity of it. It is a loose joint—not a flail-joint—but it is a little loose. The moment the muscles contract the joint is as firm and secure as a normal joint. The power of extension is preserved. The patient is able to play golf well.

REMARKS

In those cases of ankylosis of the elbow-joint in which a diseased process has subsided (tuberculosis, gonorrhæal arthritis, the arthritides from other chemic or bacterial causes) and in those in which an old fracture of the elbow existed, arthroplasty will often secure a more useful joint than excision.

Ankylosis of the elbow in youth below the age of union of the epiphysis to the diaphysis should not be treated by operation. After the full growth of the individual is reached then operation may be done without fear of impairing growth.

Arthroplasty is indicated in those cases of joint ankylosis in young adults in which motion with power is desired.

Lexer in a recent paper before the American Surgical Association upon "Substitution of whole or half joints from freshly amputated extremities by free plastic operation" objects to arthroplasty because of a fear of subsequent ankylosis. This objection in my experience with the elbow-joint does not hold if sufficient bone is taken away so as to secure a freely movable joint before the plastic is done.

FIG 1



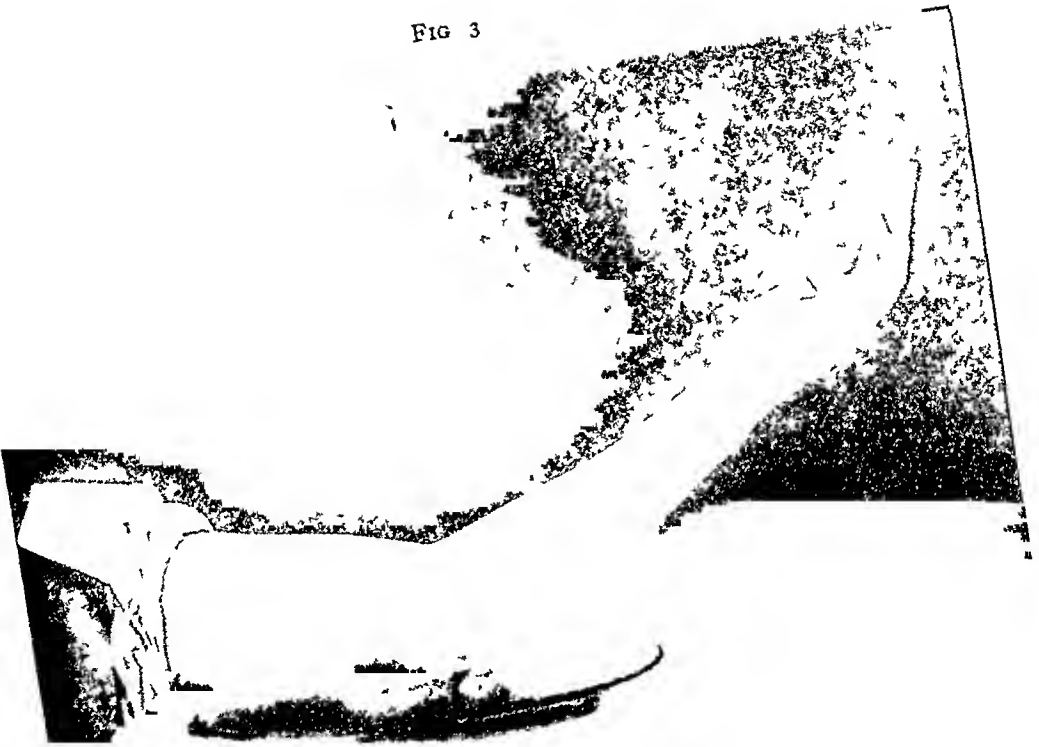
Fracture of internal condyle of humerus with a transverse fracture of the shaft of the humerus Taken one month after the accident Note the displaced fragment (X ray by Cole)

FIG 2



One month after operation. Note none of the radial head removed wire in olecranon, displaced and attached internal condyle utilized as a new condyle (X ray by Brown.)

FIG 3



Voluntary extension one year and a half after operation of arthroplasty

FIG 4



Voluntary flexion one year and a half after operation

I have had one case in which, because of attempting to preserve too nice and accurate a bony joint, a partial ankylosis followed an arthroplasty

The flail-joint of an ordinary excision is to be avoided. A stable joint with power in extension is desirable. Power in flexion is naturally present. An arthroplasty preserves power in extension.

Arthroplasty is especially applicable to the elbow-joint—less so I think to the knee and hip.

SOME SURGICAL CONDITIONS IN THE KNEE-JOINT.

BY BENJAMIN TENNEY, M D,

OF BOSTON, MASS,

Surgeon to the Boston Dispensary, formerly Instructor in Anatomy in the
Harvard Medical School

At the 1906 meeting of the American Medical Association some speakers whose enthusiasm and success in other operative lines is above question, expressed themselves as against operative repair of patellar fractures and this probably describes their attitude towards all knee-joint operations of choice. While this hesitation must be the result of their own observation, it does not seem to the writer to be justified by the best results obtainable.

There are three possible dangers in knee-joint operating—to life, to limb and to function.

The danger to life is small. In my paper in the ANNALS OF SURGERY for July, 1904, I found 297 recorded personal operations in the previous nine years on clean knees without a death. From the combined reports of the Massachusetts General and the Boston City Hospital covering the ten years preceding 1907 I find that 487 presumably clean knee-joints were opened with three deaths from sepsis, one from cerebral hemorrhage, and one from delirium tremens. There is a death-risk in all surgery, but since the complete section of all ligaments and exposure of the entire joint-surface has been practiced in septic conditions, I think the mortality will run lower than for the simpler aseptic abdominal operations. There should be practically no mortality.

The risk to limb has also been nearly eliminated by the operation referred to above. Amputations are reported less and less, and if the complete drainage-operation be done early enough an amputation should never be required. No amputations were performed in my previous list of operations. I have found one recorded since that list was made up.

The possibility of more or less loss of function remains to be considered. Permanent disability after operation on a clean joint almost without exception indicates adhesions within the joint. If adhesions could be prevented we should always get good functional joints, provided our diagnosis and treatment were correct.

I have dissected three joints showing fibrous ankylosis—one tubercular and the other two old cases probably not tubercular, but infection unknown. There was no adhesion of articular cartilage to articular cartilage in any of them, there was adhesion of a semilunar to the femur over an area of a half centimetre in diameter in one of them, and in every possible place there was adhesion of synovial membrane to synovial membrane in all of them. This suggests that in the knee-joint we can compare the adhesion problem with the same problem which has been much more studied in abdominal conditions in spite of the fact that there are both chemical and mechanical differences between the great synovial and the greater serous cavity.

The abdominal cavity is lined with serous membrane which is provided with stomata against constantly moving muscles which act as natural drainage pumps. Some parts of the walls and probably of the abdominal contents are always in motion, in spite of which we may find pus confined to a very small area. In the abdomen there are innumerable thin-walled blood-vessels which can play their osmotic part in the removal of fluid.

The knee-joint is lined with synovial membrane which secretes a thick lubricating fluid. No suction apparatus independent of ordinary joint-motion has been demonstrated, and there is no extensive system of thin-walled blood-vessels. Moreover an infection confined to one part of the cavity does not seem possible.

Clinical experience shows that the two cavities react to trauma and to some infections quite differently. We never see the abdomen fill up with serum as a result of a contusion.

or aseptic laparotomy, while we have all seen knee-joints distended from similar causes

Outside of miliary tuberculosis, portal obstruction, chylous ascites, certain cancers, and conditions producing general dropsy we know of no cause which will keep the abdomen distended with fluid for weeks, but blood has been found in a knee ninety-eight days after injury and gonorrhoeal infection may keep a knee more or less distended for months. Under some conditions this may be an advantage. Suppose a case like those mentioned in the part on "Pads." After a tab is caught and partially crushed, the synovial fluid is poured out freely, the capsule is stretched and the tab is pulled out from between the bones.

It is not at all uncommon for patients to say that their knee works better when it is swelled, but such knees are continually getting into trouble until the surgeon or rarely some extra violence removes the offending tab and then the trouble is over. In any case the "water on the knee" which is often blood—the "chronic synovitis" the "subacute rheumatism" or whatever it may be called is almost always a symptom of some mechanical damage within the joint, and demands a real and accurate diagnosis by which only can we apply rational and appropriate treatment.

If we accept the conclusion that the natural drainage of the knee is so much inferior to that of the abdomen particularly when we follow the conventional treatment and immobilize the joint, it seems possible that we can improve results in aseptic knee-joint operations by providing for escape of the excess of joint-fluid for a few hours and by allowing as much motion as safety from bleeding and security of the sutures will permit. In septic conditions there is no longer any argument as to the desirability of opening, washing and draining freely, but I believe we should go further. There is never perfect rest in the abdomen. Walls or contents are always in motion so long as breathing lasts. Why then should we strive for perfect immobility and continuous contact of inflamed surfaces in

septic conditions of the knee unless we are deliberately trying to get ankylosis?

I believe that there will be fewer cases of ankylosis after operation on septic knees when we learn and insist on the proper amount of movement during the drainage and convalescent stage

My preference is to use nothing stiffer than a hair pillow splint after operation and trust to the slight involuntary movements of the patient for preventing adhesions. If a splint be used the surgeon can break up the soft adhesions in twenty-four hours and every day thereafter by ten or fifteen degrees of passive motion

Sepsis after operation will almost always leave some limitation of motion, but if knee-joint sepsis is not too severe to recover through incision and drainage we ought to begin motion early enough and persist until we have gained all possible for the patient. Drainage should be kept up until pure yellow synovia appears and motion should be started before the drain is removed, if as usual the joint is immobilized. Such limitation of motion as comes from infiltration and stiffness of the fibrous capsule can be taken care of later but adhesions gain strength the longer they are undisturbed

The most essential element in avoiding infection is of course asepsis. Sterile gloves, instruments, sutures and dry-goods are demanded and provided for almost all operative work, but a sterile operative field is even more important in knee-joint work than in other locations where nature can take care of a certain amount of infectious material

We can open an abdomen in an emergency with no more preparation of the skin than is possible on the operating table and with confidence in the result so far as the incision is concerned, but the knee is a different proposition. The skin over the knee is smooth in complete flexion, but is folded into fine wrinkles in extension, and the razor and scrubbing brush cannot remove the surface epithelium so well if preparation be done with extended knee as they can on a smooth abdominal wall or a flexed knee

On most persons the skin over the knee is more exposed to dirt, cleanses itself less by perspiration, and receives less scrubbing with soap and water than the skin over the abdomen.

With these facts in mind I shave and scrub my knee-joints while flexed and then allow three days of antiseptic wet dressings before the final soap and alcohol preparation on the table. On my last three knees I have used an exceedingly weak solution of chlorinated soda—so weak as to cause no smarting and to give a barely perceptible odor of chlorine, with entire satisfaction.

FRACTURE OF THE PATELLA

After fracture of the patella there must be blood in the joint. Blood in the knee is always slow to disappear and with prolonged immobility may help to form undesirable adhesions. This blood can all be removed at operation. The desirability of removing bony fragments so that they may not interfere with joint-action later needs no argument.

Studies on the healing of abdominal wounds where there is accurate coaptation of tendon to tendon but where immobilization is impossible and where there must have been intermittent traction across the suture line, show dense new connective tissue at the end of two weeks.

Surely the tendon of the quadriceps kept still will be no slower in healing and passive motion ought to be safe and desirable much sooner with accurate coaptation of the torn edges of the tendon than in a case where the intervening space must be bridged across through blood-clot by the fibrillæ growing from the severed ends. This means absence of permanent adhesions, for adhesions gain in strength as does the sutured tendon, and a patient will easily endure their rupture at the end of a day or two, when he would require an anæsthetic, bleed more, and very likely reproduce them because of the pain on voluntary motion at the end of four or six weeks.

Tension on the sutures is very slight unless the fracture be old and fragments widely separated, but if a knee is sewed up without drainage there may be tension from an excess of synovia poured out after the washing and the secondary

FIG 1



Five months after fracture and suture of patella, with chromic catgut

trauma In some cases this will produce the same sort of pull on the sutures that distention of the intestines produces after a laparotomy It is only necessary to leave in a twisted silk-worm gut drain for a few days to avoid this, which is a real discomfort to the patient and a slight risk to the sutures No infection from a properly prepared skin and dressing will travel up against the constant outflow of the first three days

Absorbable sutures seem to be used almost universally now and to my mind they are the only ones to be considered The ultimate strength of the tendon depends on its reproducing its own tissues and any suture-material remaining at the end of four or six weeks is only a foreign body—useless if not a nuisance

The complete restoration of the patella is of less importance than careful coaptation and suture of the aponeurosis on either side and any fragment of bone which cannot be held in place by sewing through its periosteum may as well be removed It may do harm by furnishing a rough posterior surface to the patella while its absence is of no great consequence

From the same sources before referred to I have collected the cases of fractured patella from 1897 on There have been 378 cases of which thirteen were compound Of these 195 were wired or sutured with five deaths of which three were operative There were two deaths among the cases not operated It is interesting to note that in 1897 16 per cent were sutured in some fashion and in 1906, 60 per cent Apparently all patellæ operated were wired previous to 1899 and in 1906 there were more than three sutured to one wired

The accompanying X-ray (Fig 1) taken five months after suture of aponeurosis and patella with chromicized cat-gut, the patellar sutures being passed mattress fashion through the aponeurosis over the patella, shows conclusively that neither drill, wire nor silk are needed for a perfect result The patient, G L G, 26, female, ruptured her left patella and aponeurosis February 21, 1906 Five days later, after three days of preparation at her home and assisted by her

physician, Dr J H Costello, the joint was opened, clots washed out, and the suturing was completed as above-described with silkworm gut drainage. Three days later the joint was moved for the first time, in six days a light plaster was applied and the patient got out of bed. Her recovery was uneventful in every way.

INFRA- AND SUPRAPATELLAR PADS

There are certainly two types of patients who present themselves with disability due to hypertrophy of these structures. The most common type in my experience is usually a woman and almost always fat. Almost every physician recalls the dissecting-room subject with the thick layer of subcutaneous fat, fat about the nerve and vessel trunks, fat between and within the muscles, and fat even within the bones themselves. In the knee-joints of such specimens are found exceedingly well-developed fat-pads both above and below the patella and almost invariably their edges will show a degree of fringing which indicates mechanical damage. Many patients with such structures come to us complaining of sore knees and disability particularly on stairs. They suffer from a vicious circle of their own—they are fat and walking is uncomfortable, therefore they do not walk and therefore they become more fat and walking is increasingly difficult. They are not patients who easily consent to operation nor are they always desirable risks.

In my hands baking has given no permanent and little temporary relief to such patients. Massage has been a little more useful. Bandages and elastic knee-caps have restricted the movements of the joint and thereby diminished the passive pain and some of the pain on motion for a time.

These tabs may be found as I have before stated, connected with the suprapatellar fat-pad and catching between patella and femur or connected with the infrapatellar pad and catching between femur and patella or femur and tibia according to their attachment to the upper or posterior part of the pad. As a temporary relief to these patients I have found firm pressure by adhesive straps to be sometimes useful.

FIG 2

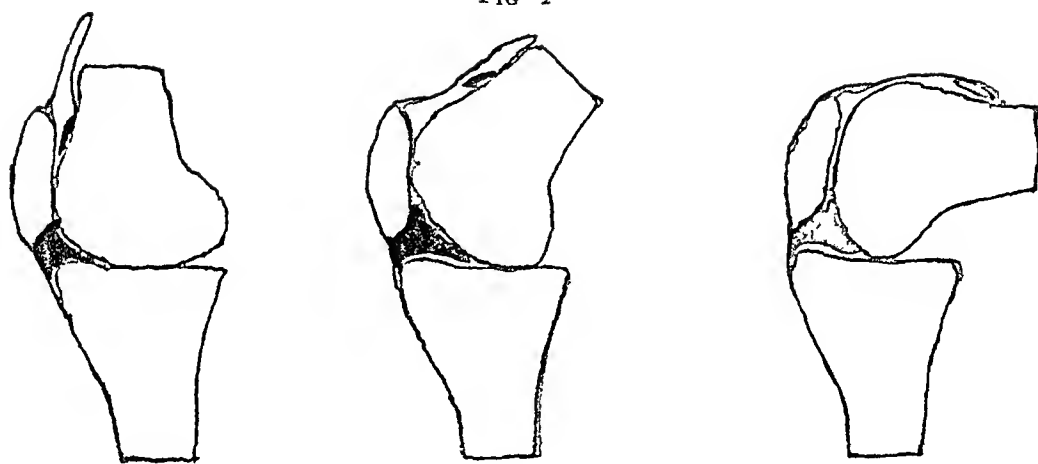


Diagram showing the relation of the supra- and infrapatellar pads to the bones in different positions

If the offending tab be catching between patella and femur the pressure should come below the patella. If the tab catch between the femur and tibia the straps to give any relief should be applied so as to compress the capsule above the patella, but relief is less certain with tabs in this location.

If the patient can be made to lose flesh either by diet or by thyroid feeding the symptoms will sometimes disappear probably because the intra-articular masses shrink as fat is absorbed from the rest of the body.

An example of this type of patient was T. P. A., 39 years old, seen in 1904. In ten years of married life her weight had increased fifty pounds. Formerly athletic, she had given up all out-door sports, and complained bitterly of the pain caused by active extension of both knees. In extension the infrapatellar pad caused a decided prominence on either side of the patellar tendon and was tender to external pressure. There was no history of any injury to or snapping within the joint, but with slow passive extension pain could be produced and the characteristic crushing sensation felt. Under thyroid feeding, she lost sixteen pounds in four months and the disability in her knees at the same time. She has kept her weight down and now plays tennis and goes up and down stairs with comfort. The external tenderness is seldom present, though there is more than normal prominence over the infrapatellar pad. Some day she may require operation, but so far she has done very well without it.

The other type of patient is often young, in good physical condition and frequently athletic. I do not know how early these tabs may begin to cause trouble, though I have seen them from twelve years on. In such individuals I think any temporizing measures a waste of time if the patient will consent to operation. The tab is probably fibrous and growing more solid with every healing after being hurt. There is increasing possibility of its throwing its owner down in some unpleasant situation, and the recurring periods of disability mean much compared with the few days of convalescence from the slight operation required for removal. To show the sim-

plicity of the diagnosis and operation I have selected two cases

The first, H C W , 22, male, student He was an athlete preferring long-distance runs He was seen in February, 1906, in Dr A M Cleghorn's office with a swollen and painful knee which had annoyed him twice before after a long walk He was conscious of something catching at times, more often when going down stairs, and passive flexion with pressure on pad and patella produced a characteristic slight snap

His joint was opened at the Stillman Infirmary February 11, and a thick, slightly-fringed pad was removed from the upper part of the infrapatellar pad The incision was closed except for a silkworm gut bundle at the lower end of the wound, which was removed in five days, when his knee was first moved His splint was removed on the tenth day, he left the hospital on the seventeenth day, and walked into my office with a cane on the twenty-third day with very little enlargement of the operated side, and approximately 120 degrees of flexion During the summer of 1906 he rode a trotting horse, swam, played tennis, danced and walked without any discomfort in the knee This tab was removed before the rest of the joint had become in any way damaged, and there is no reason to think that this knee will give him any further trouble

Another case is Mrs D B R , who had been on crutches most of the time for fifteen months, and had tried every palliative thing that could be suggested even to the actual cautery on the skin over the pad Tabs were present in both knees One knee was operated December 6 and the other December 18, 1907, at the Boothby Hospital Both joints were drained, no splint except hair pillow was used, and she went home on Christmas day She gave up crutches within ten days and began to travel over the stairs In February she went skating, and was free of all discomfort though her muscles had not fully recovered from their long disuse

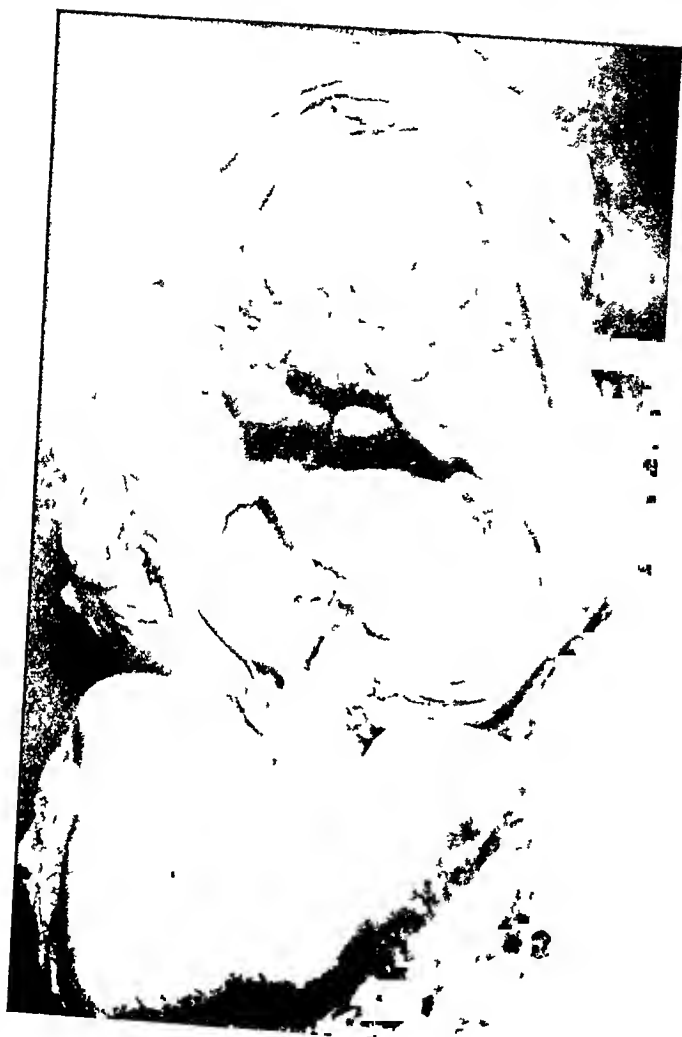
Figs 3 and 4 reproduced from my previous article show two varieties of these disabling structures The one shown in Fig 3 will produce a snap as it slips from between patella and femur, while the one in Fig 4 will give the crushing sensa-

FIG 3



Solid tabs from infrapatellar pad

FIG 1



Fringed tab from infrapatellar pad

FIG. 5



Microphotograph of tab from infrapatellar pad Case II

tion and be more constantly painful. A cross-section of one of these fibrous tabs is shown in Fig 5. Here the loss of synovial covering over one surface, probably femoral, the presence of numerous vessels near the surface and the complete replacement of the normal fat and areolar tissue by dense connective tissue are well shown.

Acute External Dislocation of the Patella.—This injury was discussed anatomically in my previous paper but at that time I did not realize the part which muscular violence plays in producing it.

J. R., 21, student, was wrestling with a 200-pound friend when his left knee suddenly gave out with some pain. He noticed his patella on edge at the outer side of the joint, and while his friends were pulling his leg he pushed the bone back into place. The leg was put on a ham-splint, and I saw him within a few hours. There was no ecchymosis, very little swelling of the joint, and no great tenderness. A depression could be felt at the inner side of the patella.

Dr. E. A. Codman saw him with me and agreed as to the desirability of operative repair. December 17, 1906, at the Stillman Infirmary, the joint was opened through a vertical incision internal to the patella. The skin and superficial fascia were the only protection to the joint. The internal patellar ligament, the insertion of the lower portion of the vastus internus, and in fact, everything that makes up the capsule was torn from the inner side of the patella and its tendon, and the lower part of the vastus was split horizontally from the rest of the muscle. The capsular rent was therefore about five inches long, and the separation an inch and a half. Incidentally the rent had torn away the inner side of the prepatellar bursa opening this into the joint-cavity. No difficulty arose in suturing the parts back into place, a silk-worm gut drain was left in, and he was put to bed with a ham-splint. One of the skin sutures caused a little annoyance but otherwise his convalescence was uneventful. He left the hospital on the eighteenth day with 80 degrees of painless motion. One month later he had given up his cane and enjoyed dancing a whole evening, and on February 19 there was no limp, very little thickening anywhere about the joint, and painless flexion of over 130 degrees.

So far as I know there is no published record of immediate repair of this injury. Two acute cases have been dissected and described—one at autopsy, and the other after amputation of the otherwise injured thigh. In no text-book is immediate repair even suggested as far as I have gone through them, and yet such repair as takes place without suture leaves the joint particularly liable to recurrence of the accident. In fact nature's repair of the condition as I saw it and as before described might leave a man more disabled than nature's repair of the torn patella and aponeurosis.

I am confident that no surgeon who realized the degree of separation and length of scar-tissue required to fill in the gap would allow a patient to recover with such a deficiency and probable recurring trouble if conditions were suitable for operating. The annoyance of the slipping patella is well known.

Bursæ—Many bursæ give no symptoms whatever and produce no deformity to cause their owners uneasiness. The worst that can come from leaving such undisturbed is an increase in size with corresponding discomfort or æsthetic annoyance to the patient. The most common bursa to be shown the surgeon is the prepatellar. It may be dissected out and removed entire. This can be done with cocaine, but would not be done on me without general anæsthesia. A certain amount of rest would seem desirable until the raw surfaces lose their sensitiveness.

I have treated eighteen by stabbing them at their lowest point, cutting upwards until the hole will admit a cotton swab in a pair of snaps, pressing out all the fluid and fibrin masses, scrubbing the interior thoroughly with a carbolic acid swab, and leaving in a bundle of sterilized silkworm gut for a drain. If the drain is not used I do not think the result is certain for the sac usually fills again. With the drain left in until nature treats it as a foreign body, I have always been successful in abolishing the sac. If the skin be cocaineized before the stab the rest is almost painless, and immediately after the patient can walk and work, except kneeling, with comfort.

Complete obliteration may take three or four weeks, but usually about ten days.

The prepatellar bursa never communicates with the joint-cavity except that also be distended with fluid and this condition I have seen but once, and then after an acute external dislocation of the patella. The bursal sac is single and never lobulated to a degree that prevents a free scrubbing of its whole interior. For this reason it is well adapted to the treatment suggested, which is not recommended for any other bursa about the joint.

There is no other bursa about the knee except the one under the patellar tendon which does not at some time communicate with the joint-cavity. Consequently I prefer to dissect out all other bursæ.

These appear in various situations external to the fibrous capsule, and sometimes seem like hernias of the synovial lining. They are painless unless inflamed or pressing on some nerve, though they are often inconvenient. It is a help in determining whether a bursal sac communicates with the joint to remember that the capacity of the joint itself is greatest in 30 degrees flexion, much less in extreme extension, and least in extreme flexion. Therefore a sac flaccid at 30 degrees flexion and tense in the extreme positions differs from one of equal tension in all positions in being probably an extension of the joint-cavity.

It is hardly worth while to give a case to illustrate the treatment of housemaids' knees. They are alike except that the old cases containing fibrin masses are slower in healing than those which still contain some blood or blood-clot. There is always some redness and throbbing and usually a little purulent discharge before the healing is complete.

A case of *enlarged bursa about the biceps insertion* was G. P. W., 39, male. Symptom Pain in course of left external popliteal nerve. History For about ten months he had noticed a swelling on outer side of left knee. Examination Swelling anterior to and just below the long insertion of the biceps cruris,

movable, tense in all positions, but containing fluid June 11, 1904, this was dissected out at the Boothby Hospital It was lobulated, one portion resting directly on the external popliteal nerve, and had become shut off from the general joint-cavity, though its former connection was still apparent as a funnel-shaped depression He went home the third day and into the woods a week later for his usual vacation

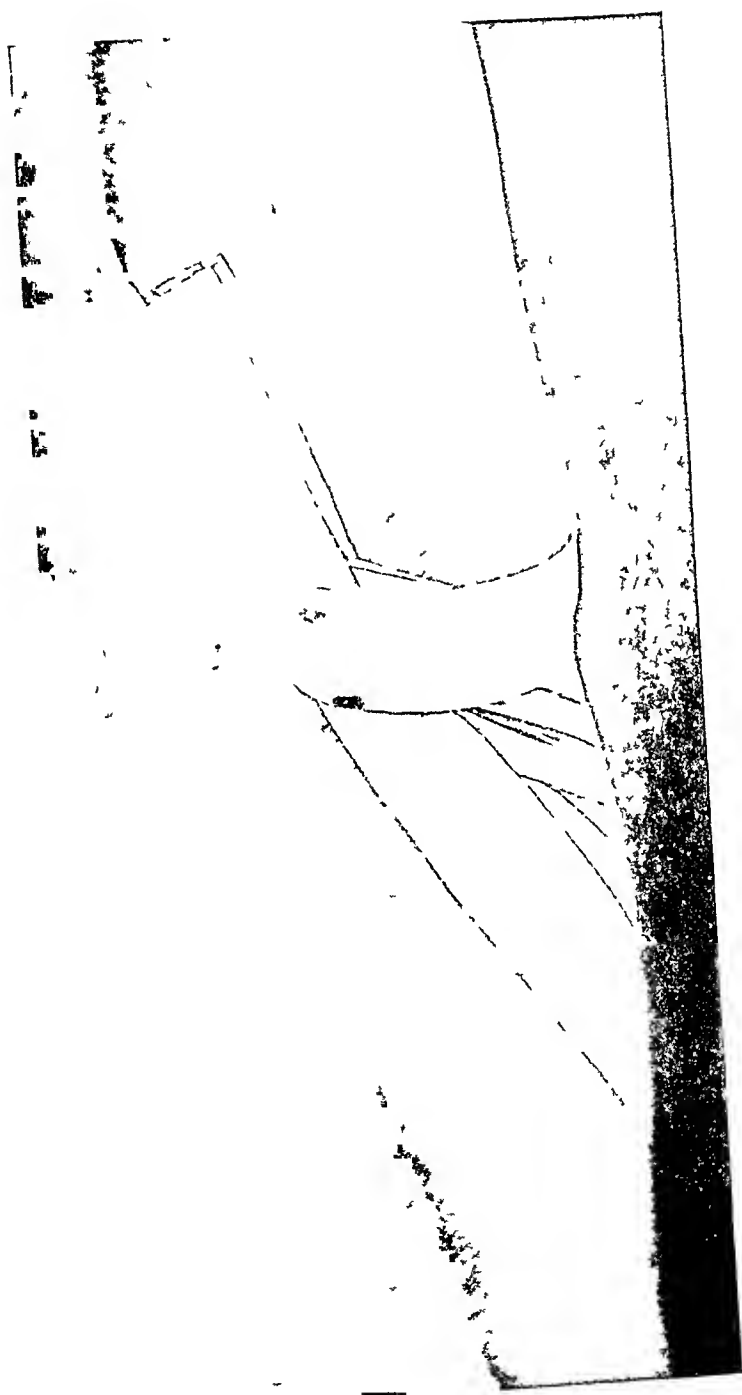
Dislocation of the Semilunar Cartilages—Though I have seen a large number of cases of internal derangement of the knee-joint, there have been comparatively few which have seemed to me to be injuries of the semilunar cartilages, and of these I have operated but one

What has seemed to me important in reviewing the notes of my paper of 1904 is that the over-riding of the internal semilunar by the femur has so small a place in operation reports On the other hand, tears of the internal semilunar between its anterior attachment and its attachment to the internal lateral ligament are often reported by operators The reason for this is to be found in the fact that any mechanical interference with extension of the knee leads to greater disability and causes more pain than an equal interference with flexion

To carry weight on a fully extended knee requires no muscular effort compared with that required if the knee be flexed, and abnormal muscular exertion brings noticeable fatigue if not actual pain Therefore the surgeon is sought for relief Further as our usual incisions do not disclose the posterior part of the cartilage, posterior injuries may be overlooked Some further experiments on cadaveric knees have carried out the conclusions previously arrived at as to the results of rotation of the leg after section of the internal lateral ligament between its attachments to the internal semilunar and the *femur* There is always increase in lateral motion and external rotation and the back portion of the cartilage can be caught between femur and tibia

If, on the other hand, the ligament be cut between its attachments to the semilunar and the *tibia* there is less increase in lateral motion and rotation, but with external rotation there

FIG 6



Spiral adhesive dressing

The two dots indicate the two ends of the internal lateral ligament

is very marked tension on the fore part of the semilunar which draws the cartilage into the space between femur and tibia. If in life while this space is obliterated by body-weight the same sequence of events occurs, rupture of internal lateral ligament below semilunar and forcible external rotation of the weight-bearing foot, it is extremely probable that the semilunar will give way at its weakest part which is its anterior attachment, or between this and its middle. The consequent limitation of motion and its complete cure by operation is well known and calls for no discussion.

I wish to emphasize the connection between ligamentous and semilunar injuries, because damage to the lateral ligaments is a very common injury often concealed under the name of "sprain" or "acute synovitis," and because proper diagnosis and treatment of injuries to the lateral ligaments are essential not only for the present comfort of the patient, but to prevent misfortune later when the violence may be less and the consequent disability greater by reason of rupture or dislocation of a semilunar.

Diagnosis of injury to the ligaments is easy in most fresh cases on account of the sharply localized tenderness over one or both bony attachments. In more severe cases where there has been complete avulsion and the joint is filled with blood there is a noticeable increase in lateral motion and external rotation, both of which are painful even after months.

Treatment of this condition should vary with the severity of the injury. With the slightest degree of damage as estimated by the increase in movement before described, the essential thing is to take strain off the ligament by keeping the knee in internal rotation and slight flexion. This can be done by a Schaeffer splint better than by any other apparatus known to me, but properly applied adhesive strips serve nearly as well, are always at hand, and require no fitting. The accompanying photograph shows an arrangement which I have used with satisfaction for the past five years.

If the injury to the ligament be fresh and severe enough to increase the lateral and torsion movements decidedly, I fully

believe that the obligation to open and repair damage is greater than with fractured patella. In both cases there is blood in the joint-cavity which will favor adhesions, and in both cases the torn surfaces are separated by blood-clot and ragged weak tissue. Nature's coaptation and repair of a ruptured lateral ligament is likely to leave the patient more of a cripple than the longest sort of a "fibrous union" patella.

The few patients with fully ruptured lateral ligaments whom I have seen some years after their injury and conventional treatment with plaster cast and massage were either on crutches or "getting along" with some sort of splint apparatus. Their condition might be worse, but to-day they ought to fare better by reason of accurate diagnosis and careful coaptation and suture.

CONCLUSION

1 Asepsis and drainage are more essential in knee-joint work than in laparotomies because of the difference in the skin of the operative fields and in the natural drainage of the two cavities.

2 Sepsis and immobility mean ankylosis. Drainage and mobility may leave some motion.

3 There is an increasing tendency towards operative repair of patellar fractures and an increasing use of absorbable material. This should be the rule to which exceptions may sometimes occur.

4 By far the most common mechanical cause of trouble within the joint is the tab from the infrapatellar pad. This may be a part of a general obesity in which case the usual anti-fat treatments are appropriate. If it be found in a vigorous and otherwise normal person it should be removed. Some temporary relief may be obtained by properly applied adhesive straps, but a cure only by removal.

5 Prepatellar bursitis can be cured by incision and drainage. Other bursæ should be dissected and removed.

6 Ligamentous injuries must be carefully treated and some must have operative repair to prevent recurring or constant disability. No apparatus is so good as a normal knee.

THE OPERATIVE TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR IN ADULTS.

BY CARLETON P. FLINT, M.D.,

OF NEW YORK,

Instructor in Surgery, College of Physicians and Surgeons of Columbia University,
Assistant Attending Surgeon to the Roosevelt Hospital

IN the treatment of fractures of the neck of the femur, operative intervention is indicated when conservative treatment has resulted in non-union or when the break is of such a character as to render this result highly probable. These indications do not apply when the general condition of the patient, either as the result of infirmities or age, is such as to influence unfavorably the prognosis. Non-union, without pain or without marked functional disability,—*i. e.*, firm connective-tissue union,—without severe symptoms, is not an indication for operation. There are rare instances when other operative indications obtain. Gérard reports intra-articular suppuration, secondary to a bed-sore, developing in the course of the treatment of a break of the neck of the femur and Moore has reported a case of compound fracture of the neck of the femur.

It is absolutely essential, for the purpose of deciding definitely upon the method of treatment, to know the line of fracture as far as is possible. For this reason a good radiograph is a *sine qua non*. In an older person no impacted fracture is immediately operable. This type of break becomes operable when the subsequent developments prove that the impaction present did not influence the process of repair sufficiently to obtain union.

An impacted break demands operation only when the patient is relatively young, and when at the same time the impaction is such as to greatly diminish the use of the leg, either as the result of pain or because of deformity. Impaction is either the result of the neck being driven into the head-

fragment or because the base of the neck is driven into the trochanter. If the neck is driven into the head in such a manner as to result in marked displacement of the head-fragment, usually downward and backward, and should it on manipulation not be possible to separate the fragments for the purpose of re-approximation, then an open operation may eventually be indicated.

A simple osteotomy, or a wedge-shaped osteotomy, may allow correction of the deformity. Should it be found at the end of one year after injury that the head of the bone is immovably fixed in the acetabulum and that there is with union sufficient deformity to interfere seriously with function, then a subtrochanteric wedge can be removed. It is my opinion that this operative procedure should not be undertaken until sufficient time has elapsed to allow union to occur,—therefore not inside of one year after the injury,—the reason for this delay being that no theoretical considerations based upon the study of an X-ray plate can demonstrate beyond question what the final functional outcome will be in a given case even when the displacement seems such as to preclude the possibility of a good useful hip. Another objection to early operation is that it is not possible to separate the fragments without further damage to the circulation,—and therefore if we are not going to run the risk of favoring non-union because of additional interference with the circulation,—we must wait until the blood supply has completely readjusted itself after the injury. If, after proper delay, it be found that the head-fragment is so greatly changed in shape that correction is out of the question, then it may be excised as a last resort, provided of course that the symptoms present can be attributed to the conditions at the seat of fracture.

If the neck is driven into the trochanteric region, no open operation will be immediately necessary. When at the time of injury the adduction, rotation outward and upward displacement is sufficient to produce deformity which would subsequently endanger function, then the impaction can be broken up and the fragments readjusted by abduction. In old

injuries where the neck is driven into the head, the operative indications are the same as in recent cases, but when the neck is driven into the trochanter in such a manner as to produce great functional interference, a wedge-shaped osteotomy (antero-superior of the neck or subtrochanteric) will be necessary.

In old people no impacted fracture, however bad the condition, demands operative interference and the abduction treatment with breaking up of the impaction emphasized by Whitman, should not be abused by application to these unsuitable cases of old age.

No non-impacted fracture in a healthy robust adult in middle life or younger is immediately operable, except in such rare cases where the head-fragment is completely turned around in the acetabulum so that the cartilage surface is in contact with the fracture surface of the shaft-fragment. When the break is close to the head the operative indications depend upon the health of the patient and upon the time which has elapsed since the injury. If the patient is robust and the break recent, an open operation is contraindicated. I do not even see any advantage in the use of Nicolaysen's method in these cases, and believe that in a fresh break the approximation produced by abduction and maintained with plaster is quite as efficient as the same treatment combined with the spike driven through the trochanter, besides having the additional advantage of avoiding infection along the track of the fixing metal. If after two and one half months it is apparent on examination that no attempt at union exists, an open operation is indicated. The data which form the basis of believing the absence of any attempt at union are: ability to push the trochanter upwards, and rotation of the trochanter in an arc smaller than on the other side. In a doubtful case two radiographs can be taken, one with the leg lying at ease and one with pressure upwards on the leg,—the difference will be apparent immediately. Crepitus is not often obtainable at this time, although a soft grating sensation may frequently be appreciated in cases where a neoarthrosis is forming. The head in such an in-

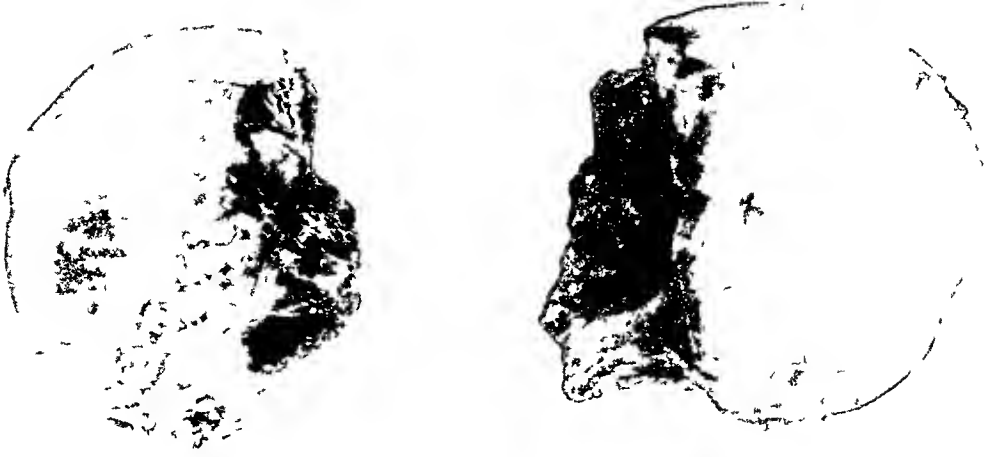
stance (Fig 1)—*i e*, break close to cartilage, and no attempt at union,—should be excised. Excision is to be preferred because the circulation has been demonstrated to be insufficient to favor union even after adequate approximation and fixation.

This decision can be reversed only in cases where interposition of tissue found at the time of operation is evidently to blame for non-union and when it is found that the circulation of the head-fragment is good.

To decide whether there is sufficient supply of blood or not it is essential to have the wound absolutely dry so that no oozing will trickle into the fracture-cavity. The fracture cleft is packed tightly with gauze which is allowed to remain for a few moments, on removal of the gauze the fracture surfaces will be examined. In most instances where the circulation is insufficient, the entire fracture-surface of the head-fragment will appear yellowish-white with areas which are smooth and glisten showing where the shaft-fragment rubbed. About the edges wherever a little synovial membrane is still attached, there will be seen irregular bluish patches indicating some slight blood supply (Fig 2). The ischæmic central area, when curetted, does not ooze—the bone seems dry and friable. The marked difference on the shaft-fragment is most striking. Portions of this will be covered with new connective tissue and if the bone is curetted, the surface oozes freely. The general appearance after removal of connective tissue is that of cancellous bone with abundant circulation.

If the patient be aged but still in good general health, the head fragment should be excised within a few days after the injury (Fig 3).

The patient cannot afford to stay in bed for the time necessary to permit of union with a break close to the cartilage and then have non-union as the result of the treatment. A stiffly ankylosed but useful hip without pain is preferable. After months of treatment,—and prolonged pain connected with early attempts to walk, the general condition is so run down that an open operation with subsequent bed-treatment is out of the question.



a *Fig 1.* *b*



Fig 2.

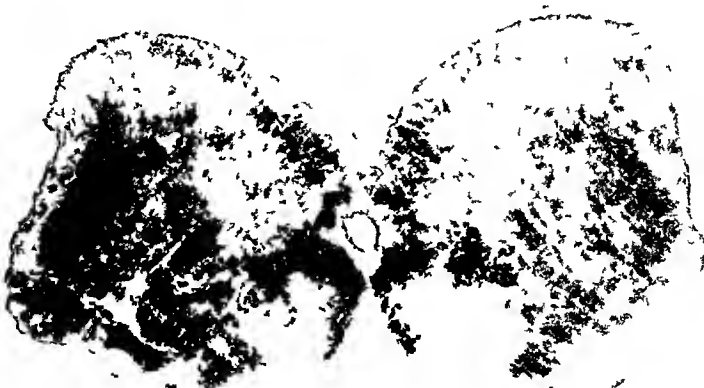


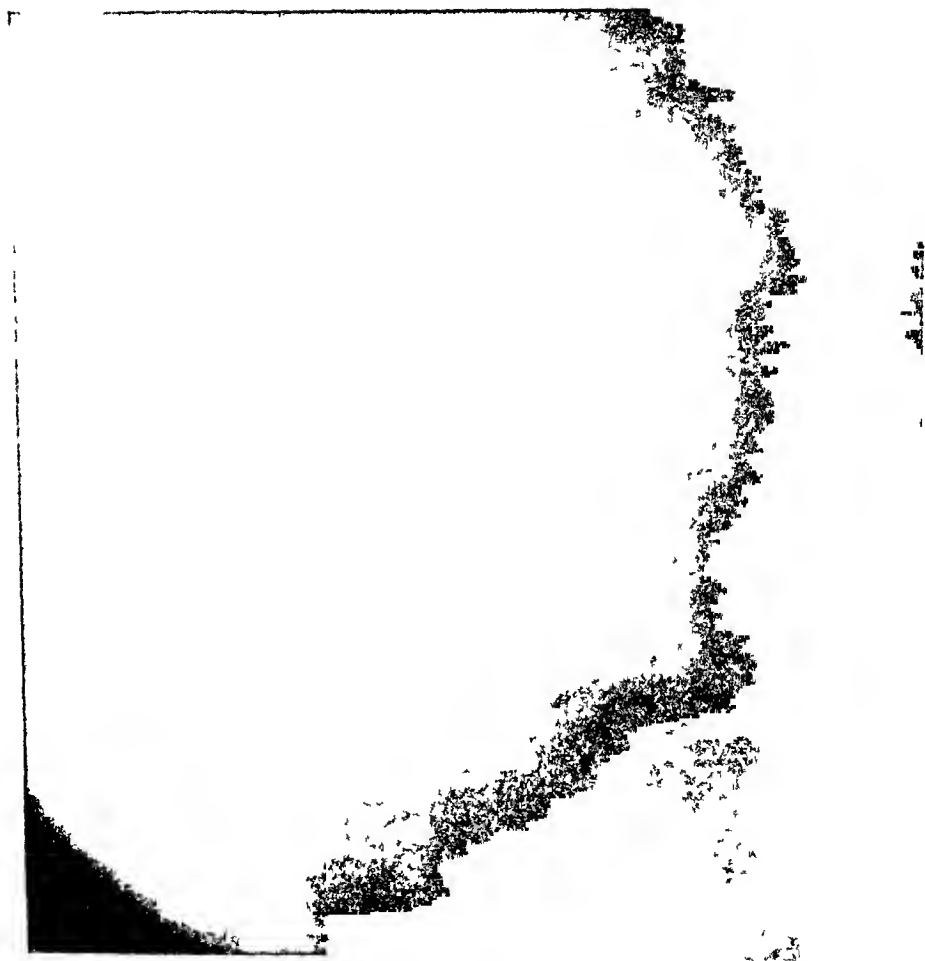
Fig 3

FIG 1—(a) Break close to cartilage Specimen removed one week after injury No impaction Woman 65 years of age (b) Break oblique close to head Specimen removed three months after injury No union No circulation Man 30 years old

FIG 2—Shows Fig 1 (b) cut 1 Slight circulation in region of ligamentum teres 2 Centre of head yellow fatty degenerated No circulation 3 Area of circulation close to attachment of synovial membrane 4 Blood-stain from operation

FIG 3—Shows Fig 1 (a) cut Mottled appearance due to areas of blood containing cancellous tissue Fracture surface did not ooze

FIG. 1



Fracture of neck of femur Break apparently well out toward trochanter specimen Fig 1(a) illustrates deception of radiograph

When the break is of the middle of the neck and the patient is robust, there is a chance that non-operative care will result in union. It is extremely difficult even from a radiograph to state the exact course of breaks in this region. The radiograph may appear to show the break farther out as a whole than most of the fracture really is (Fig 6), as is shown in the accompanying illustrations both of which are from the same case (Fig 1, *a* and Fig 4)

If at the end of two and a half months, it is evident that union is not likely to occur, an open operation is indicated. Whoever is in the habit of testing can easily detect the signs above referred to which mean absence of any valuable attempt at union.

The operation indicated, provided the circulation allows, is to fasten the two fragments together by means of a bone peg. In as much as the patient is presumably in good condition, this more accurate means of obtaining approximation and refreshing of surfaces is to be preferred to Nicolaysen's method of nailing which is less accurate and does not permit of refreshing the fracture surfaces. The disadvantage of using a metal peg is that it always becomes loose and in the majority of instances has to be removed. The metal does not serve its fixing purpose any longer than the bone peg, which is finally absorbed.

Frangenheim has demonstrated that ossification of the connective-tissue union is not liable to occur much inside of one year. It is therefore evident that if we are to run no risk, weight must not be borne on this thigh inside of one year although it would seem reasonable, that assuming the upright position with the corresponding physiological strain, would tend to favor the deposition of bone in such a manner as to restore the weight bearing trabeculæ. The early months may be passed in plaster, the later ones with a metal hip-splint.

After an operation no test but use will disclose the condition at the seat of fracture. We are sure of approximation and fixation and know, that no intervening tissue prevents

union and therefore it is best to delay this test of use until time has given the connective-tissue union opportunity to ossify

In non-operated cases which are going to unite the connective-tissue union is so firm that it is impossible to detect an abnormal joint. In fact this connective-tissue union may be so short and solid that on resuming use of the leg it may be some weeks or months before the connective tissue stretches sufficiently to give symptoms proving that the assumption of bony union was erroneous

It is my opinion that some cases which would have ossified eventually do not do so because the patients are allowed to walk and bear weight too soon. The irksome trial of waiting with an apparently good union is hard to bear. Even in cases where connective-tissue union is to be the outcome, it is far better to wait until this connective tissue is firm than to run the risk of stretching by too early straining of the new tissue. After the patient has been permitted to walk even in cases where abundant time has been allowed for union, it may become apparent within a few weeks or months that an abnormal joint exists associated with such disability and pain as to render excision of the head imperative. It is apparent then that a robust individual is obliged to sacrifice one year for the chance of saving the head-fragment in cases where the break is distinctly in the middle of the neck and it is therefore equally apparent that the operation of pegging should not be recommended unless the conditions are such as to render it highly probable that the outcome will be favorable. It must be borne in mind that even in non-operated cases it may not be possible to detect neoarthrosis until the patient walks with full weight, but in most instances two and a half months will be sufficient to make sure of the condition.

At the time of operation, *i e*, two and a half months after the injury, there may be found present in the neck, conditions which preclude a fixing operation. The crushing of the neck may have been so extensive or the break may have been so irregular that no approximation favorable to subsequent union

is possible In such an instance the head-fragment will be excised immediately

Again there may be found in the neck-fragment, cystic spaces chiefly toward the anterior surface These may be small or occupy almost the entire diameter of the neck These spaces may form recesses connecting with the general fracture-cavity, or they may be entirely separate, and broken into when curetting the surface for the purpose of examining the circulation of the fragment The contents is like the usual fracture-fluid in an old fracture-cavity; it is reddish-brown, slightly cloudy, without any evidence of blood-clot The walls of the cysts, which have come under my observation, in three cases, were not covered with connective tissue,—simply bare cancellous bone The spaces are probably due to modifications of the cellular elements of the cancellous bone secondary to impaired nutrition, which in turn is due to interference with the circulation They correspond possibly to similar cyst forming degenerative changes observed elsewhere in the connective tissues of the body In the instance of a woman about forty, there was one cyst about one inch in diameter near the anterior wall of the neck The break was about six months old In another case, a man of fifty-eight years, there were several small cysts This break was of fourteen months' duration In another case, a man thirty years of age, there was one large cavity which communicated with the fracture-cavity This break was of about four and one half months' duration The first two were transverse breaks in the middle of the neck, the latter was oblique, close to the cartilage line The spaces contained no dead bone These cysts when large, preclude approximation and unless the circulation of the remaining portion of the neck is very good, the head had better be excised In an aged person with a break of the middle portion of the neck, no open operation for the purpose of approximation and fixation is ever indicated The outcome of such operations at my hands has not been favorable These people have not time or vitality which enables them to spend one year with a doubtful outcome at the end of this time

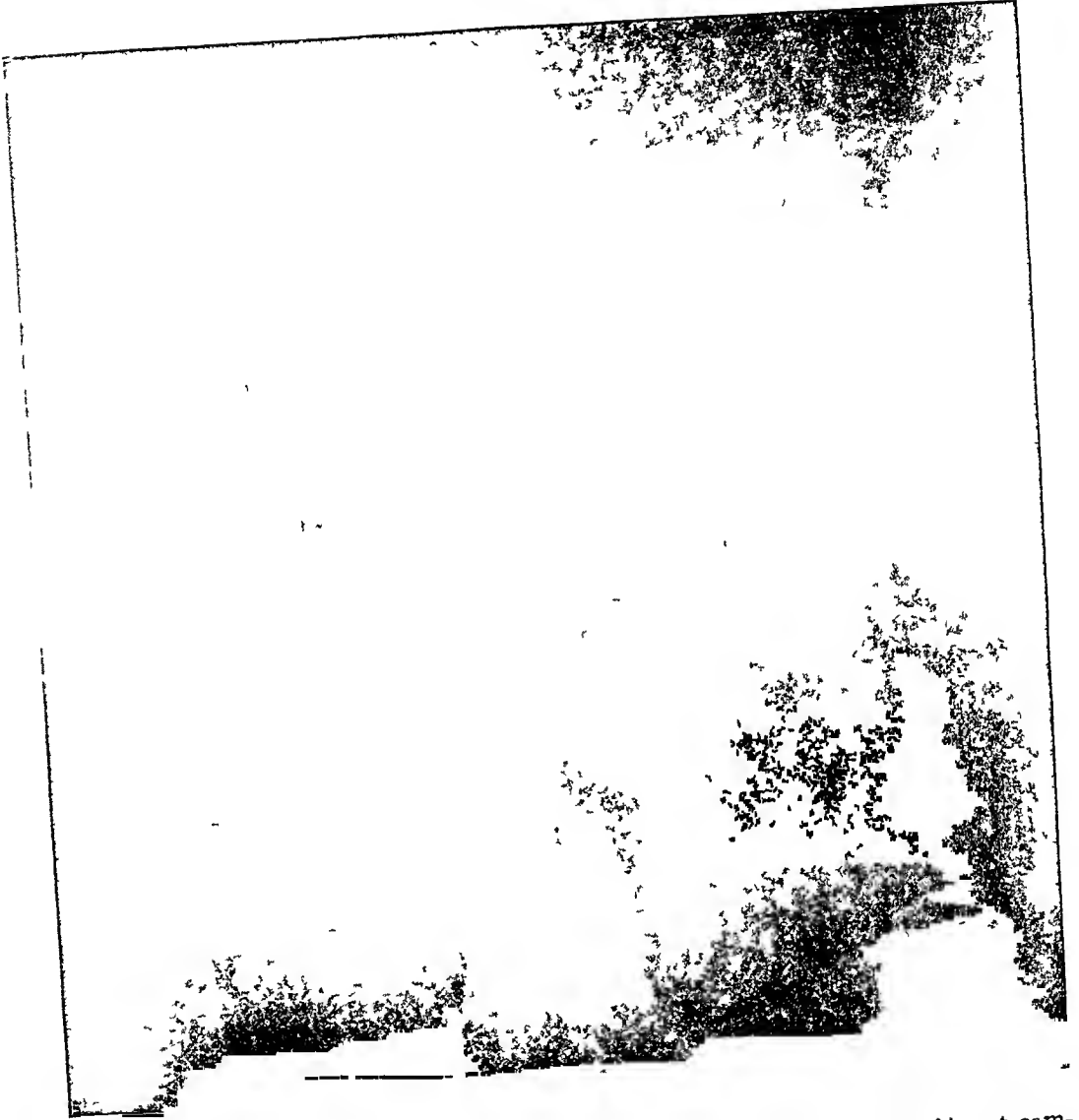
Nicolaysen's operation has been recommended for these old people, for instance, by Cobb. As already stated, it is my opinion that abduction with plaster fixation is to be preferred, and should subsequent examination reveal a neoarthrosis, or non-union, it is better to excise the head, provided the patient's general condition permits.

If the injury be old when first seen, the only treatment in cases of non-union, is to excise the head whether the patient be aged or young.

If a neoarthrosis has existed, even a few months without proper fixation, there is upward displacement, rotation outward and adduction. Even though traction is applied for some time, it is usually not possible to restore the normal position of the fragments. The neck of the femur gradually becomes absorbed,—both the piece connected with the head and the fragment attached to the shaft. This absorption continues until the trochanter base of the neck comes in contact with the brim of the acetabulum, hence the protected head remains intact (Fig 5).

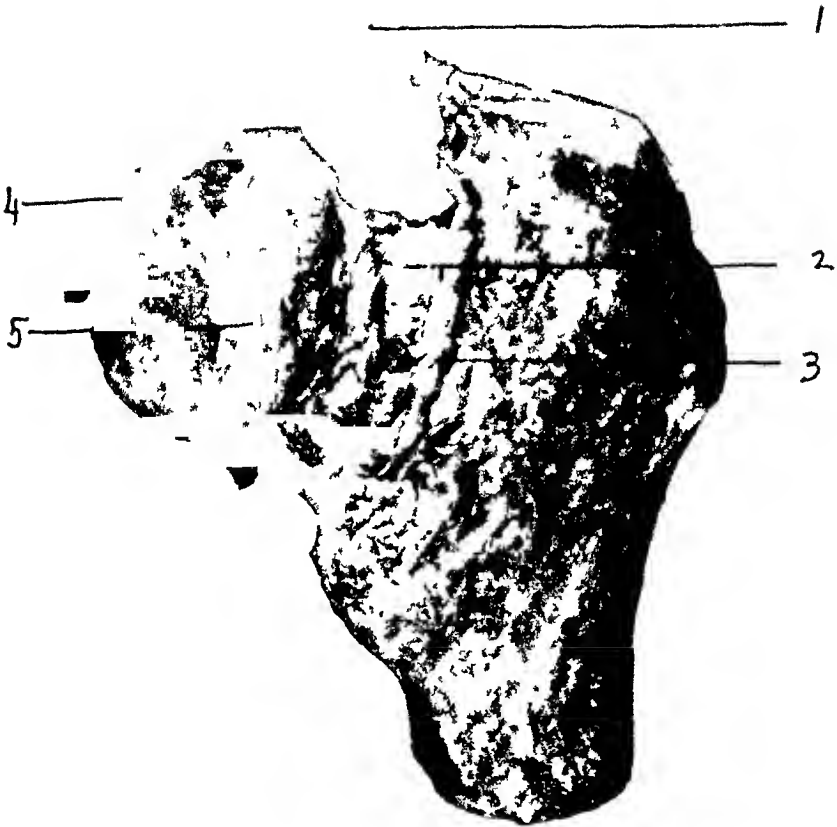
Even when absorption of the neck is not complete, any operative method aiming at approximation and fixation is not feasible for the following reasons. The head itself has become fixed in the acetabulum, there is connective-tissue union between the central portion of the acetabulum and the head itself. The cartilage in this region is destroyed. Where cartilage is opposed to cartilage, however, there is no destruction and no adhesion unless there has been an injury of this particular region (Fig 6). The absorption of the neck progresses in a plane which corresponds to the rotated outward, abducted and upward displaced shaft. Should it be possible to restore the fragments to their normal level, it will be found that after placing the shaft-fragment in its physiological position,—therefore after correcting the adduction, abduction and upward displacement,—that there is a gap between the fracture surfaces. This gap is widest below and behind. Only the upper and anterior portion of the neck will be in contact. In cases which have existed a long time, it is

FIG 5



Fracture of neck of femur Woman 55 years of age Break 3½ years, Almost complete absorption of neck Marked pain Treatment Excision of head, fixation of shaft to pelvis

FIG. 6



Fracture of neck of femur. Break middle of neck. Young man. False Joint. Fibrous union. Specimen obtained after death several years later. (Case of Dr Marvel Long Branch N. J.)

1. Gaze in abnormal joint. 2. Fibrous union surrounding neck and forming capsule for new joint. 3. Edge of normal capsule (cut away). 4. Cartilage destroyed opposite centre of acetabulum. 5. Normal cartilage opposed to cotyloid cartilage of acetabulum.

not possible on manipulation to overcome the adduction enough to restore the shaft even to the normal straight position without division of the adductors. These conditions prevent approximation and fixation in the normal straight position, to say nothing of a slightly abducted position which would be preferable.

It is therefore best to excise the head. This applies to old fractures in the young as well as in the aged. Six months of non-union will show the effects of absorption and one year will make changes enough to preclude any fixing operation. In most instances the neck will be completely absorbed at the end of two and a half years (Fig 5). It is therefore apparent that as a rule no matter what the age of the patient, excision will be resorted to in cases of non-union which have existed for one year. To fix the two fragments with the thigh adducted and rotated outward so as to obtain approximation is to court failure because of the subsequent functional disability due to malposition. Even if union did occur a secondary subtrochanteric osteotomy would be necessary to relieve the deformity.

Whenever non-union occurs with a break at the base of the neck, a very rare complication of this accident, the same indications apply as with breaks in the middle of the neck. The decision will be modified more often in favor of saving the head-fragment because of the better conditions of the circulation in the neck-fragment. Base fractures have a tendency, particularly when the trochanter itself is injured, to throw out a great quantity of callus and to form osteophytes which may obstruct union. This callus formation has given rise to operative interference, but personally I have had no experience with a case in which it seemed to be wise to interfere with the callus because of the limitation of motion.

Operation for Exposing Seat of Fracture —The exposure which seems to me most desirable is obtained in the following manner:

The skin incision carried to fascia, extends from about $1\frac{1}{2}$ inches behind the anterior superior spine on the crest of

the ilium downwards and backwards to the posterior margin of the trochanter, and then vertically down the thigh about 5 inches (Figs 7 and 8) The skin behind with fat is now

FIG 7

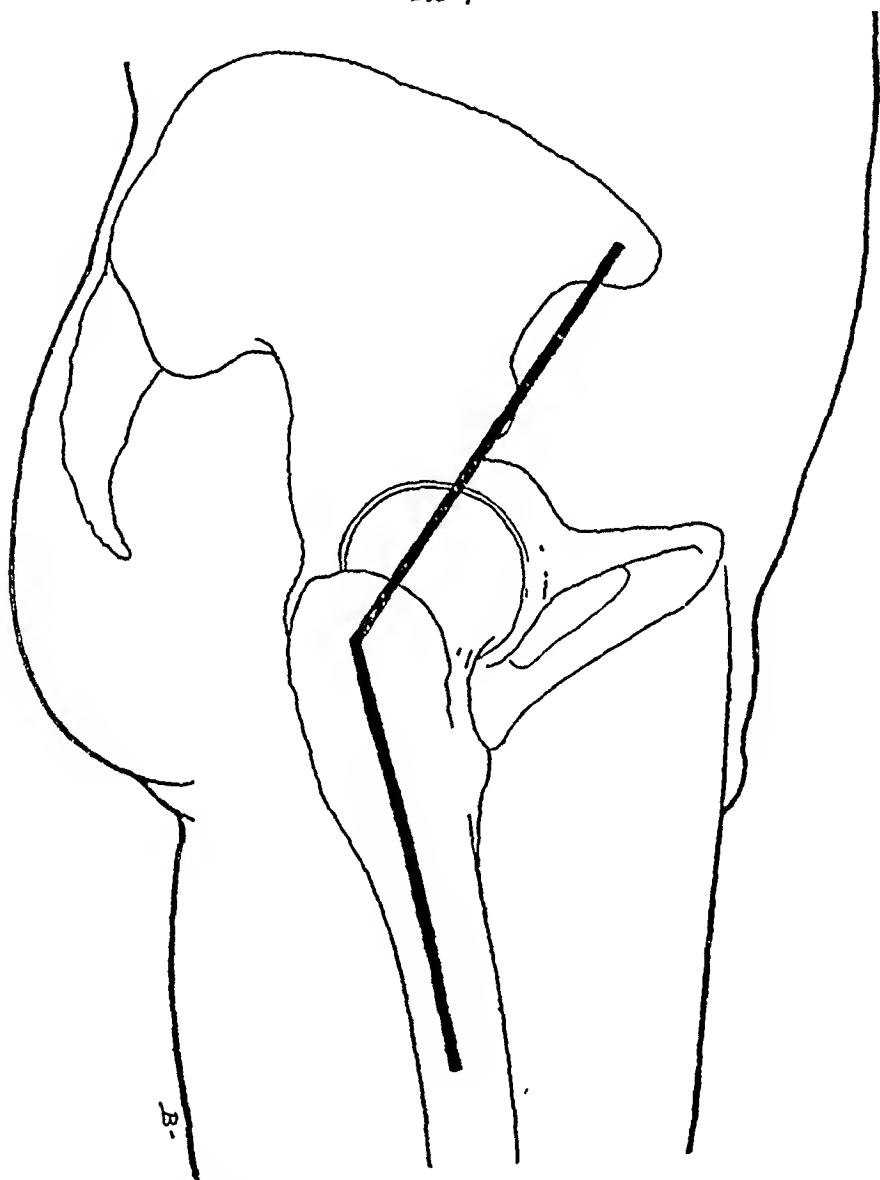
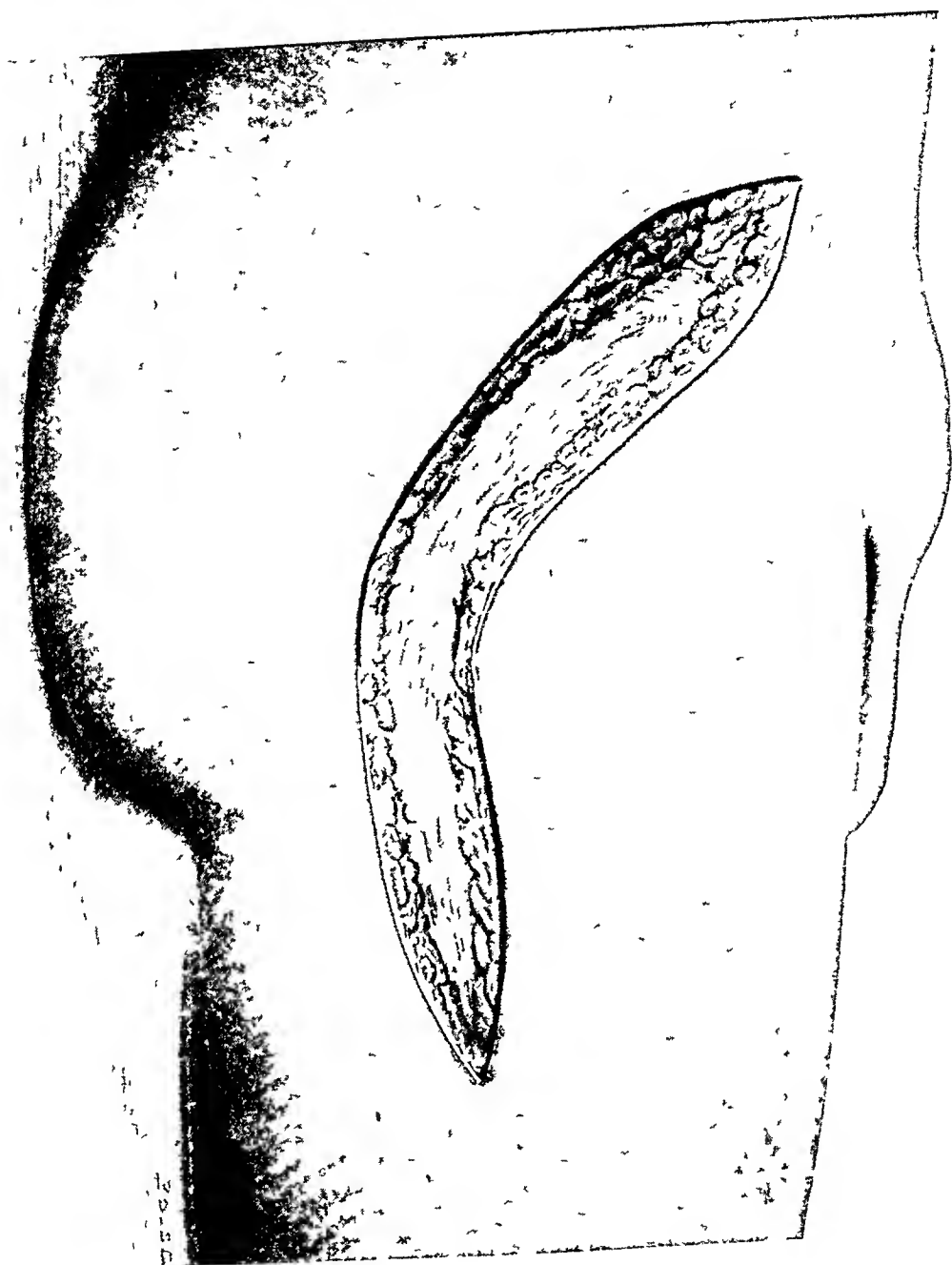


Diagram showing relation of line of incision to bony landmarks

separated from the fascia overlying the tensor vaginæ femoris, leaving the anterior skin-flap in place The fascia is divided along the posterior margin of the tensor vaginæ femoris from

FIG 8



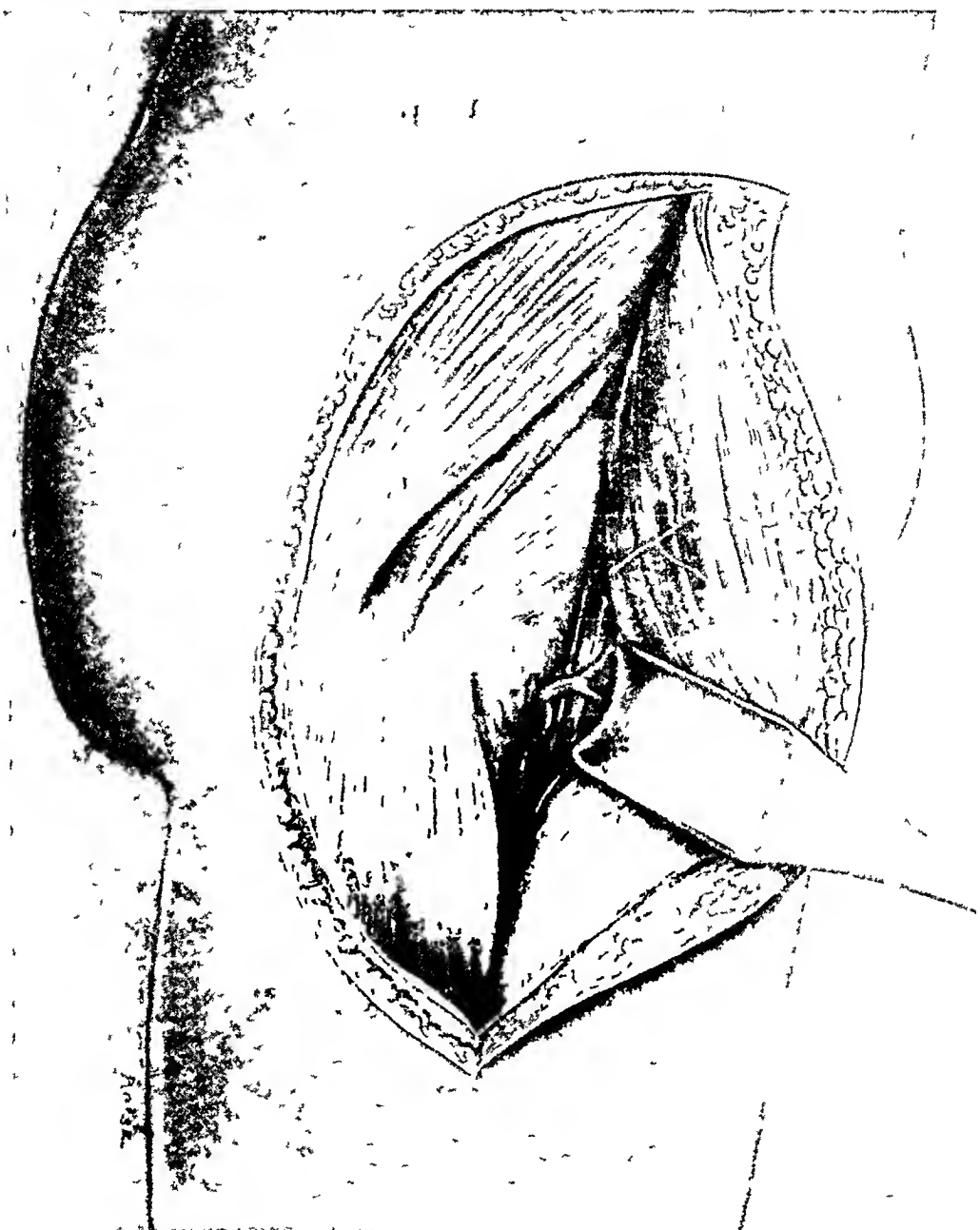
Skin incision

FIG 9



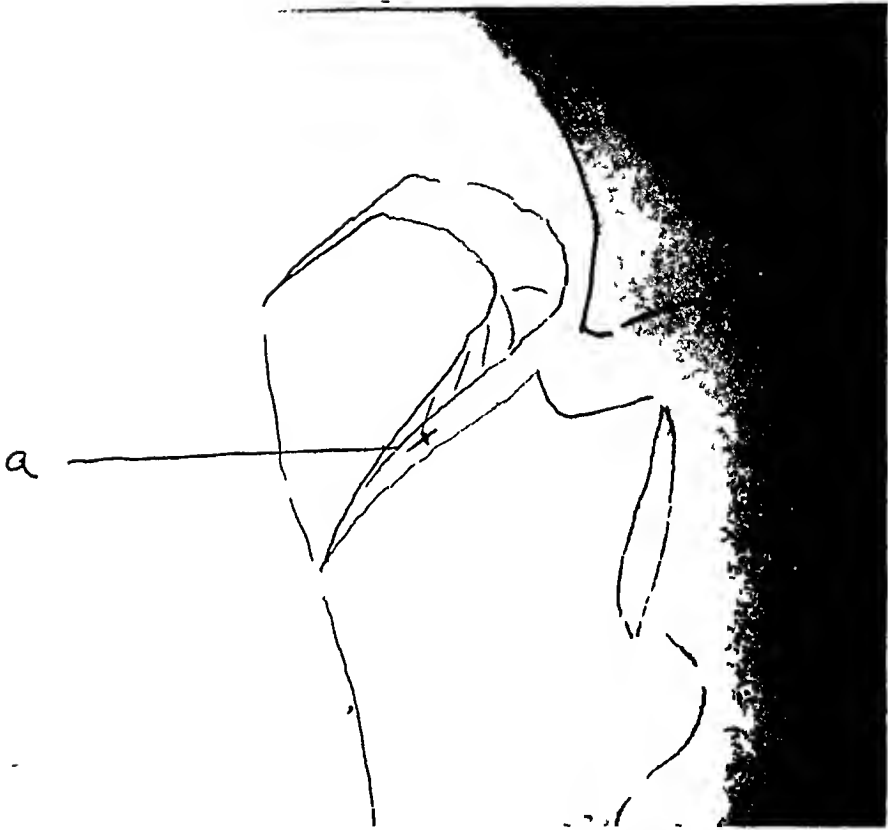
Division of fascia and tendon of tensor vaginae in the femoral region

FIG 10



Tensor vaginae femoris pulled inward exposes triangle from which fat pad has been removed. Internal boundary rectus femoris Superior boundary blended margin of gluteus medius and minimus Inferior boundary vastus externus Floor capsule of joint with "Y" ligament Anterior margin of greater trochanter crossed by external circumflex vessels.

FIG 11



Illustrative case Excision of head Remnant of neck in acetabulum, (a) osteotomy of
trochanter good functional result No pain and $\frac{3}{4}$ in shortening slight motion at hip

the crest of the ilium down to the tendon, and the tendon itself is divided from behind obliquely downwards and forwards (Fig 9) This skin-subcutaneous fat fascia and muscle-flap is turned forwards, exposing a triangle bounded above by the fused margins of the gluteus medius and minimus, internally by the rectus femoris and inferiorly by the vastus externus This triangle is filled with a fat-pad and is traversed in the lower part by branches of the external circumflex vessels This fat-pad is excised in toto to expose the floor, which is formed largely by the anterior margin of the trochanter major, the capsule of the hip-joint, the antero-external brim of the acetabulum The inner boundary of the floor is the external margin of the ileofemoral ligament The digital fossa is exposed above, and along the margin of the acetabulum, the reflected head of the rectus femoris (Fig 10)

By rotating the thigh slightly outwards, the exact seat of the break can be felt The capsule is divided by an incision starting at the brim of the acetabulum close to the thick fibres of the "Y" ligament, and carried downwards close to this ligament until opposite the place where the external part of the capsule becomes attached to the neck, the incision is then carried upwards dividing the capsule on the neck close to the bone When this triangular flap is retracted, the break is easily examined Should it be found, on exposing the floor of this triangle, that the break is partly inside and partly outside of the capsule, great care should be taken not to divide the portion of the capsule attached to the head-fragment Plenty of room can be obtained by dividing the portion attached to the shaft-fragment anteriorly and below

By abducting and rotating outward, a very good view of the fracture is obtained At this point the fracture-cavity should be carefully packed with gauze and the operation delayed for a few moments to allow checking of all oozing On removal of the gauze the condition of the circulation in the head-fragment is observed, whether there are ischæmic areas or not, whether the bone oozes after slight curetting, or whether there are cysts or not

In a case which has existed for some time a new connective-tissue capsule for the neoarthrosis will sometimes be found within the normal capsule and attached to the respective margins of the break (Fig 6) At first sight this connective tissue will appear as a rather firm connective-tissue union, but if it be cut it will be found that the central portion, corresponding to the cancellous tissue of the neck, presents a cavity filled with a moderate amount of sticky reddish fluid and lined with granulations In other instances the fracture-surfaces are worn smooth, the head-fragment in particular being devoid of granulations, whereas the shaft-fragment is covered with smooth connective tissue This condition is found in older cases

In very recent cases, the fracture-cavity is filled with the ordinary sanguineous fracture-fluid found about most fractures

If the head-fragment is to be excised, the slight remaining attachments about the neck are divided as well as the connective-tissue union to the shaft-fragment when present. A curved blunt instrument is now inserted between the head and the acetabulum, the head pried off and a stout knife curved on the flat introduced to divide the ligamentum teres After this has been accomplished, the head-fragment is rotated within the capsule until the smooth articular surface faces outwards Two blunt instruments are now passed into the acetabulum behind the fragment which is easily forced through the opening in the capsule It is an advantage to have the smooth cartilage surface present in the capsule opening This is not possible when there is much neck attached

The older the injury, the greater the difficulty in removing the head because of the connective-tissue union to the acetabulum After removal of the head-fragment, the cotyloid cartilage is removed with a large sharp spoon A transverse osteotomy is done at the base of the trochanter from the digital fossa side This enables the trochanter to be tipped outwards when the head is placed in the acetabulum The osteotomy should be slightly oblique and outwards so that the trochanter

may fit in the angle between the shaft and the pelvis. There may be quite an annoying hemorrhage at this point of the operation from the artery lying in the digital fossa.

The anterior inferior margin of the acetabulum should be cut away for the reason that if this projecting lip is left the shaft of the femur will be rotated outward after being placed in the cavity. The periosteum over the brim of the acetabulum, the outer side of the shaft of the femur and the inner side of the trochanter should be stripped up so as to permit of bony approximations.

After the shaft has been placed in the acetabulum, the trochanter is fastened to the pelvis by means of a stout bone peg, and this fixation reenforced by suturing the periosteum of pelvis and trochanter with chromic gut. The operation is in this respect the procedure recommended by Gangolphe (Fig. 11).

In recent cases these steps are exceedingly easy, whereas in older cases great difficulties are met because of the changes in muscles and ligaments. In an old case, it may be necessary after removal of the head to abduct the leg to about 90 degrees, if possible, engage the top of the femur in the cavity and gradually force the leg down. At times it may be necessary to resect the upper portion of the trochanter. If there is much tendency for the femur to leave the acetabulum, it is best to fix the femur to the pelvis by means of a bone peg of 25 F calibre. The position of the femur should be about 30 degrees abduction with the patella pointing straight upward.

After suturing the capsule fascia and tensor vaginæ femoris tendon with interrupted catgut, the skin-wound is closed with a small rubber tissue drain in the lower angle.

From the time the shaft is placed in the acetabulum until the plaster dressing is hard, an assistant holds the leg in the desired position.

When on operation, examination reveals conditions which permit of an attempt to preserve the head-fragments, the fracture-surfaces are freshened with a curette (Fig. 12). After this, it must be ascertained that the head-fragment is

movable at least enough to allow adjustment with the leg in a corrected position. After this readjusted position has been obtained, preferably with the leg abducted and rotated so that the patella faces straight upward, the neck is bored through the trochanter in the direction of the break, this being inwards, slightly upwards and slightly forwards. The upward and inward direction can be regulated according to the position of the neck but the forward angle must be estimated. One feels the drill pass the trochanter cortex, the next firmer resistance is met in the region of the break and finally the resistance at the cartilage is encountered. The distance in an adult man is about 4 inches and in a woman about $3\frac{1}{2}$ inches (Fig 13).

The bone peg best adapted is made of the shin-bone of an ox turned on a lathe or sawn out and filed practically round. It is not well to have the peg absolutely round and if turned on a lathe, it should be fluted. The engaging end should be slightly conical for the reason that after removal of the drill and introduction of the peg, some slight motion may take place between the fragments. A shoulder presents, and if the end of the peg exactly fits the opening it will not engage in the drill-hole of the neck-fragment. It is desirable to have the drill of irregular shape fluted because this irregularity enables the blood in the drill-opening to escape. If this opportunity is not afforded the incompressible blood is driven into and injures the cancellous tissue. For the purpose of sterilizing, the peg may be boiled on two consecutive days for about half an hour. I have used such pegs many times in different regions of the body, and have as yet seen no bad results except in the case of an os calcis where, owing to a fault of my own, the peg was not driven in sufficiently through the tendo Achillis and therefore rubbed on the boot.

A large bone peg absorbs in about ten months to one year.

Other Methods of Exposure—An incision is made downwards from the anterior superior spine. The fascia to the outer side of the sartorius is divided and by blunt dissection,

FIG 12



Fracture of neck of femur Man 34 years of age Break close to base 6 months' duration Suitable for attempt at pegging if operative findings permit

a



Fracture of neck of femur Break about one year duration Man 55 years of age Bone
peg in situ Border line case because of changes in neck

the tensor vaginae femoris being pulled back, the region of the joint is reached (Hueter).

Another variety of the anterior exposure is to separate the muscles to the inner side of the sartorius, penetrating to the outer side of the rectus femoris. Both of these wounds are narrow and deep, the exposure for extensive work and examination is not good, retraction is difficult, and the field at the bottom of the wound is small.

The "U"-shaped lateral exposure, without division of the trochanter, is insufficient for exposure. When the trochanter is divided (Gillette), the exposure is very good to be sure, in fact better than any other, but in my opinion the method is unnecessarily destructive and in the event of an excision not being necessary, demands the fixation of two fragments to the shaft.

In cases where an excision is to be considered *a priori*, the method is excellent, inasmuch as an osteotomy of the trochanter is essential to place the shaft in the acetabulum and frequently partial resection of the trochanter is imperative.

Kocher's posterior exposure through an angular incision is far too extensive an operation to be considered in connection with fracture work as Kocher has himself emphasized.

A "T"-shaped incision has been used by Painter. For most work the anterior angular incision above recommended will be sufficient and in cases where excision is contemplated *a priori*, Gillette's "U"-shaped incision with division of the trochanter.

For fixing purposes, wire, screws, nails and bone can be used. A bone peg, such as is recommended by Gillette and Peckham, has the advantage that it can be used of large calibre so that there is less tendency to cut the cancellous tissue because of the strain put upon it. Another advantage is that the material, although foreign, does not necessitate removal as frequently as metal pegs and finally the peg becomes absorbed in the course of time.

I have considered these advantages sufficient to warrant giving a bone peg preference and have therefore always used

a freshly prepared peg In other regions of the body, I have used ivory pegs but find that although satisfactory, they take longer to absorb Wire has been used successfully by Koenig and Painter, screws by Trendelenburg, Freeman, Moore, *et al*, and steel nails by many Thompson, Painter, Cobb, Gelensky, Herz, Maitens, *et al*

Thompson recommends two nails side by side, Lund fixed the fragments by driving the nail through the head into the acetabulum

Gangolphe endeavored to prevent the shaft from riding up by detaching the greater trochanter and fastening it to the upper margin of the acetabulum to deepen the socket as it were (See above)

Gelensky filled the gap between the two fragments with "ausgegluhter" bone and fixed the bones with Gussenbauer's clamp, which was removed on the 37th day The pieces of bone were cast off

After-Treatment—Postoperative dressing Whether the head of the bone has been resected or not, the first dressing should be a solid plaster cast extending from the toes to the nipple line with the leg in an abducted position This position is always possible in resection cases but may not be in cases where a pegging operation has been performed

This plaster must be so arranged that the wound can be dressed and at the same time the greatest strength must be on the outer side in the region of the hip and waist so that adduction cannot recur Another essential point is to have the plaster so arranged that during the first weeks traction can be used

It is therefore best to apply a solid spica from above the knee to the nipple line, over this is placed a strong moulded plaster external splint reaching from the axilla to the toes This in turn is bound to the underlying plaster by strong muslin bandages A window is cut in the underlying spica

At the end of four weeks, the bandages should be removed from the peg below the knee and the knee flexed daily over the edge of the bed At the end of eight weeks, a fresh firm spica

is applied including the pelvis and thigh, the leg being still abducted

From this time on it is permissible to allow the patient to use crutches although no weight is to be borne on the leg. When a pegging operation has been done, a Thomas hip-splint should be used from the eighth week on. This splint should be worn for one year—in other words, long enough to give the fracture time to ossify.

In excision cases, at least six months should be allowed to pass from the time of operation before the patient bears weight on the leg.

If, after a pegging operation, the patient is allowed to walk before sufficient time has elapsed to permit of bone being deposited in the newly formed connective tissue, it will be found that in the majority of instances, the patient will be comparatively comfortable at first but that within a few months, as the leg begins to be used more and more, pain reappears together with a varying increase in the amount of shortening with some adduction and rotation outward. The new connective-tissue union was short enough and strong enough to sustain the weight of the patient with comparative comfort for some time, but with increasing use this union stretched and a new neoarthrosis formed. The operation in this instance is not a success for in spite of the fact that for some time the condition is better than before operation, there is a gradual return of the pre-operative conditions. It is not safe to state inside of one year what the final outcome is to be.

Immediately after resuming use of the leg with or without excision of the head, the patient seems much improved for the reason that the adhesions secondary to the operation and the fixation have immobilized the bones sufficiently to prevent pain. It is the pain more than deformity or limp which incapacitates the patients. After a few months' time it will be evident whether or not the relief observed immediately after operation is due to conditions which are permanent.

When the operation with pegging is completely successful, the result is very good indeed. There is no pain, very slight

shortening with objective limp, very little deformity and a perfectly useful leg

When the pegging operation is less successful there may be union with marked shortening, some abduction and rotation outward, distinct functional deficiency, but still a leg which is serviceable with a cane and without marked pain

In other cases fairly successful, the connective-tissue union is sufficiently firm and short to give fair functional result with not much pain, often some degree of motion which is probably at the seat of fracture. There is some adduction and rotation outward with shortening and limp. Either of these possibilities is a great improvement over the original condition, because of the absence of pain and better ability to get about

When the operation is a failure, the condition of the hip gradually returns to what it was before operation and finally assumes the condition observed in non-united fractures of the neck of the femur which have not been operated. At first there is apparent improvement, less pain on motion, greater ability to move the leg, which is particularly emphasized in the ability to push the leg forward and lift the foot off the floor, while sitting in a chair. As time goes on and the strain put upon the leg increases, the symptoms of discomfort increase rather than diminish as in cases where the union, either fibrous or bony, obtained is sufficient to meet the requirements of use. This increase of symptoms is due to the gradual stretching of the supporting structures. The trochanter finally displaces upward on the outside of the ilium

When the head has been excised, the result aimed at is to have the shaft-remnant of the neck or the upper end of the femur remain ankylosed by bony union in the acetabulum. If there remains some motion at the hip, as is occasionally the case, this fortunate event at the present state of our knowledge must be considered accidental and cannot be attributed to purposely prepared conditions at the time of operation. It would seem as if a long neck-fragment on the shaft protruding into the acetabulum favored this result. It is my opinion that

methods of treatment favoring this result such as passive motion, should not be instituted in the hope of obtaining motion, until sufficient clinical evidence has accumulated to demonstrate the conditions which must be present to expect such an outcome and at the same time protect from displacement of the femur upwards

The conservative aim must as yet consist in an endeavor to obtain firm ankylosis. Such an individual will have a useful leg, no pain, but some deformity with varying degrees of rotation outward and perhaps adduction. There will be some shortening and objective lameness, which, however, is largely offset in cases which have united with the leg abducted by compensatory tilting of the pelvis and lumbar curve of the spine and which may be relieved to some extent even in cases which have united with the leg straight or adducted by the use of a high sole.

The least desirable result is to have the femur escape from the acetabulum and displace upwards. There is shortening, lameness,—subjective and objective,—rotation outward and adduction. The pain, however, is not as great as a rule as in cases of non-union, where the head-fragment is still in place and corresponds more to the condition of patients who have had non-union for many years and whose tissues have finally become adapted to the abnormal state of affairs in such a way as to lessen the amount of discomfort. The only advantage may be in this instance that the period of extreme discomfort is shortened.

The majority of the patients having had an excision will derive benefit, whereas the outcome of a pegging operation is far more doubtful and should therefore be limited strictly to the very few cases, the characteristics of which have already been enumerated.

THE CONSERVATIVE TREATMENT OF FRACTURES OF THE FEMUR

NOTE ON THE END-RESULTS OF SIXTY-ONE FRACTURES OF THE FEMUR
CONSERVATIVELY TREATED

BY ASTLEY PASTON COOPER ASHHURST, M D.,

OF PHILADELPHIA,

Surgeon to the Out Patient Department of the Episcopal Hospital

AND

WILLIAM A NEWELL, M D.,

Resident Physician, Episcopal Hospital, Philadelphia

THERE is at present a manifest tendency towards the operative treatment of recent fractures of the long bones, even when the fractures are not compound. Fractures of the femur, which are generally recognized as the most serious of all such fractures in regard both to their immediate mortality and their ultimate results, appear to offer no exception to this modern tendency, which some surgeons would even dignify by erecting into a rule of practice. It seems incumbent, however, on those who thus seek to alter the traditions of surgery either to demonstrate the evil results which they regard as a necessary consequence of accepted methods, or to bring forward proof that by operation still better results can be obtained, and without unjustifiable risk to the patient. The advocates of operative treatment, in short, should either be able to show that the methods they propose will not increase the immediate mortality, and will greatly diminish or altogether prevent the unfavorable results of conservative treatment, or, failing this, they should at least convince conservative surgeons that the functional results of the accepted forms of treatment are such as can no longer be tolerated.

Sir Thomas Myles (Med Press and Circular, 1907, lxxxiv, 35), speaking recently of fractures of the femur, said

* Read before the Philadelphia Academy of Surgery, June 1, 1908

"My own experience of the result of routine treatment in these cases is not very encouraging. I have found that in nearly all cases occurring in adults there has been considerable shortening and consequent lameness, some stiffness in the knee-joint, some limitation of the movements of rotation at the hip-joint, a varying degree of muscular atrophy, pain with changes in the weather, and almost always an ugly knob of callus to be felt or seen at the seat of the united fracture. At first I felt inclined to blame myself for these results, but further study of the subject soon taught me that they are the invariable and inevitable results of the methods of treatment usually adopted." He adds that it has hitherto been an accepted fact "that shortening of an inch or two is the inevitable outcome of such injuries, and that nothing can be done to prevent it." In support of these positive assertions he calls to witness museum specimens and skiagraphs, but in regard to such testimony we think it should be borne in mind that the former are selected as curios, and hence the chief desideratum is the presence of deformity and exuberant callus, while skiagraphs are notorious for exaggerating any deformity which may exist. Moreover, Myles presents no details of the end-results of the operative treatment which he so vehemently urges.

Among other surgeons who are champions of the operative treatment of recent fractures may be mentioned Lane and Knaggs, in England, and Vaughan and Martin, in this country.

König (*Arch f klin Chir*, 1907, lxxxiii, 1032) favors operative treatment for recent fractures of the cervix, the trochanters, and for supracondylar fractures, fractures of the shaft he thinks may give quite satisfactory results under conservative treatment.

Bardenheuer (*Die allgemeine Lehre von den Fracturen u Luxationen*, Stuttgart, 1907, 304), on the other hand, does not favor operative treatment at all, he calls attention to the fact that in spite of the advances in aseptic technic Tuffier among 22 such operations had 3 to suppurate.

The end-results under conservative treatment have not received much attention, with the exception of those of the neck of the femur, most surgeons are content with the "general impression" they have received from the results of the cases under their treatment. In fractures of the cervix femoris the prognosis as to ultimate function has generally been regarded as gloomy, but M^r Bryant (cited by Stimson *Fractures and Dislocations*, New York and Philadelphia, 1899, 326) was much more optimistic as to these patients than most surgeons, on more than one occasion he said that all his hospital cases of fracture of the cervix for many years (42 cases, average age 70 years) "went out with good and useful limbs", a statement, which, as Stimson remarks, indicates much better results than have been reported elsewhere, even if the standard of "good and useful" is only that the patient can stand and walk a little with the aid of a cane. But it may be recalled that Dr Le Conte, before the Philadelphia Academy of Surgery (*ANNALS OF SURGERY*, 1905, 11, 284), stated his impression that 80 per cent of his patients with intracapsular fracture were discharged "with useful and valuable legs".

Scudder (*Treatment of Fractures*, Philadelphia, 1907, 6th ed, 336) reports the end-results of 16 fractures of the neck of the femur treated at the Massachusetts General Hospital. Only three of these patients were over 60 years of age at the time of the accident. Only two patients had functionally useful limbs, while thirteen had to use a crutch, a cane, or had disability in going up and down stairs. J B Walker (*ANNALS OF SURGERY*, 1908, 1, 84) has recently published an investigation of 112 cases of fracture of the neck of the femur treated at the Bellevue Hospital, New York. There were 18 deaths, an immediate mortality of 16 per cent (a number of patients, also, were transferred in a few days to other institutions, if these were included the mortality would probably be higher), 10 patients were still under treatment in the wards, 32 could not be traced, and of the 52 patients who were traced, no less than 30 (57.6 per cent) were found

to be incapacitated, 12 were still compelled to use a cane, and only 10 (less than one out of five) could do their normal work

Certainly there is a marked divergence between the results reported by Scudder and by Walker, and those observed by Bryant and by Le Conte

As a contribution to this subject we have studied 121 recent fractures of the femur which have been under treatment in the Episcopal Hospital during the last three years, and we take this opportunity to acknowledge the courtesy of the staff in permitting us to examine their case-records and their patients. Although there have also been admitted during this time a few patients with ununited fractures of the femoral neck, these have not been included in our statistics, as the object was merely to ascertain the end-results of conservative treatment of recent fractures

The following classification has been adopted

Region of Femur Involved	Condition on Discharge
Cervix, 58 cases	Cured, 20 patients, improved, 20 patients, not improved, 2 patients, died, 16 patients
Trochanteric, 13 cases	Cured, 12 patients, improved, 1 patient, died, 0 patient
Shaft, 32 cases	Cured, 26 patients, improved, 1 patient, died, 5 patients
Condyles, 18 cases	Cured, 15 patients, improved, 2 patients, died, 1 patient

There has been no distinction made in our figures between intra- and extracapsular fractures of the neck of the thigh-bone. It is distinctly stated in only two cases that the fracture (cervix) was still ununited on discharge; but it is possible that no union was present in 8 other patients. It is reasonably certain, however, that firm union (probably not bony in all cases) was secured in 29 patients (69 per cent of those who recovered). We have classed as trochanteric both fractures

"through the trochanters" and "subtrochanteric" fractures, and among fractures of the condyles are included, besides 15 typical "supracondylar" fractures, also 2 cases of fracture through the external condyle, and 1 case of compound epiphyseal separation, all three of the last-named fractures involving the knee-joint

The mortality among these 121 cases was 18.1 per cent

CAUSES OF DEATH

The causes of death may be seen in the following table

Cervix, 16 deaths, mortality 27.6 per cent. shock, 2 patients, pneumonia, 3, decubitus, 3, exhaustion, 5, uræmia, 1, cancer of the pylorus, 1, enlargement of prostate, 1 (Age varied from 59 to 84 years, 11 patients being over 70 years, and the period until death varying from 1 day to 10 months).

Trochanteric, no deaths

Shaft, 5 deaths, mortality 15.6 per cent. other injuries, 3 patients, aged 76, 51, and 60 years, delirium tremens, 1, aged 33 years, pneumonia, 1, aged 71 years, after five days

Condyles, 1 death, mortality 5.5 per cent. œdema of lungs, 1 patient, aged 66 years

With the exception of the fractures of the neck of the femur there was only one fracture in which on discharge firm bony union had not taken place. This patient, a woman aged 65 years, with a fracture at the junction of the middle and lower thirds of the shaft, went home over ten weeks after admission, wearing a plaster cast, with fibrous union. It has been impossible to trace her since her discharge more than two years ago. Several skiagraphs made while she was under treatment showed good apposition of a nearly transverse fracture

The treatment adopted has been so various as to be fully representative. While all the surgeons employ longitudinal traction by means of Buck's extension apparatus, some use only sandbags in addition, others will have none of sandbags, but employ Volkmann's sliding splint, and some are partial to the double inclined plane, Smith's anterior splint, and

other more complicated appliances. A number of the fractures of the neck of the femur have been treated with encouraging results by both longitudinal and lateral traction, as advocated in 1869 by Phillips (*Amer. Jour Med Sciences*, 1869, lviii, 398), and as recently popularized by Maxwell, Ruth, and others.

The ages of these patients varied from 4 months to 86 years.

Notices were sent to all of the 99 patients who recovered. Of these, 29 returned to the hospital for examination, 17 were examined at their homes, and accurate accounts of the present condition of 15 were received from their family or friends. It was impossible to trace 37 patients. There are thus available for our report 61 patients showing the end-results of treatment.

Contrary to our expectation, the ultimate results in those patients who did not return for examination were as good as, and in some instances better than, those in the patients who came to the hospital. Thus one old lady of nearly 70 years, with fracture of the neck of the femur, was found busy house-cleaning, having just moved all her parlor furniture into the front hall and vestibule. Other patients were visited at their places of employment, and were found too hard at work to spare the time to return to the hospital for examination.

We have classed the functional end-results under the following headings: (1) Perfect functional result, which, without regard to shortening, implies the entire absence of limp, and of any hindrance to the normal use of the limb. It should be stated, however, that none of these patients were acrobats, either before or after their injury. (2) No disability but limp. (3) Marked impairment of function, which implies that the limp was decided, and that in some cases the use of a cane, and in a few the use of a crutch, was still necessary, although even these patients were by no means helpless. Thus one patient (*cervix*), included in this class of "marked impairment of function," uses a crutch on the street, a cane at home, goes up and down stairs constantly, and supports herself by the

use of a sewing machine, which she runs with either foot indifferently (4) Incapacitated, which implies that the patient has to use two crutches, or is confined to the house

The end-results of the 61 cases may be thus tabulated.

END-RESULTS OF SIXTY-ONE CASES OF FRACTURE OF THE FEMUR TREATED CONSERVATIVELY

Site of Fracture	Cases Treated	Cases Recovered	Cases Traced	I Perfect Functional Result	II No Disability but Limp	III Marked Impairment of Function	IV Incapacitated
Cervix	58	42	21	5	8	6	2
Trochanteric	13	13	9	5	2	2	0
Shaft	32	25	22	14	8	0	0
Condyles	18	17	9	4	3	0	2
Total	121	99	61	28	21	8	4

Forty-one patients were examined for shortening, the results are shown in the accompanying table

SHORTENING

Site of Fracture	No of Patients Measured	No Shortening	Shortening less than				
			1 cm	2 cm	2.5 cm	4 cm	5 cm
Cervix	12	1	3	3	2	2	1
Trochanters	6	1	2		1		2
Shaft	17	5	8	4			
Condyles	6	1		1		3	
Total	41	8	13	8	3	5	4

Among 41 patients measured, 8 or about one-fifth, recovered without shortening, 32, or 78 per cent, had less than one inch shortening, none of the patients had more than two inches shortening, and none of the patients with fractures

of the shaft itself had more than three-fourths of an inch shortening

Speaking of fractures of the femoral neck alone, we found entirely useful limbs in 13 out of 21 cases traced, or in nearly 62 per cent. Only two patients were entirely incapacitated: one of these, a woman 80 years old, was discharged with an ununited fracture, and died at her home three weeks later; the other patient, a man 78 years old, was living six months after the accident. The average age of the 21 patients traced was over 57 years at the time of the accident, or, if two children of 11 and 15 years be excluded, the average age of 19 patients was over 62 years, 12 patients were actually more than 60 years old at the time of the accident, and 7 of these were over 70 years. Of the 21 patients with fracture of the neck of the femur who were not traced, the average age was $64\frac{1}{2}$ years, 10 of the patients being over 70 years of age. The difficulty of tracing them was no doubt due in part to some of them being dead.

Taking all the remaining fractures together, excluding those of the cervix, there were 40 patients traced. Of these, 36 (90 per cent.) had entirely useful limbs, though 13 of them had a limp. There was marked impairment of function in 2 patients (trochanteric fractures), one of whom, aged 70 years, had had the same femur fractured once before, three months previously, and the other, aged 65 years, sustained, besides the fracture through the trochanters, a Pott's fracture of the same leg. Two patients in this group were found to be incapacitated, both had supracondylar fractures—one, aged 55 years, had previously sustained a fracture of the neck of the same femur, which had united with shortening and deformity; he still uses crutches, over 18 months after his discharge,—the other patient, a woman of 62 years, has advanced rheumatoid arthritis affecting both knees and both hips, she is barely able to totter around her house.

We may conclude, then, that, with the exception of these four patients, the results of the conservative treatment of fractures of the femur, excluding those of the neck, were satisfac-

tory, and we very much doubt whether operative treatment of such cases could do more than give entirely useful limbs in 90 per cent of cases, and leave only one out of every three patients with no other functional impairment than a limp

FRACTURES OF FEMUR, EPISCOPAL HOSPITAL PATIENTS TRACED, 1905-1907 INCLUSIVE

CERVIX

1 Matthew G, 64 yrs, July, 1907 Examination 2-12-'08
Habitually uses crutch and cane Can walk without support of any kind Goes up and down stairs daily Is still improving
Shortening 3 cm, eversion, rotation fair Abduction possible to 30°, flexion to 135° Union firm (Class III)

2 Irene K, 11 yrs, January, 1904 Report 5-13-'08 No limp, all functions perfect (Class I)

3 Mary E, 72 yrs, January, 1905 Report 1-21-'08 Can walk with crutches, goes up and down stairs daily Was treated by longitudinal and lateral traction (Class III)

4 John M, 53 yrs, February, 1905 Examination 1-25-'08
Scarcely appreciable limp Rotation a little restricted, flexion to 90°, abduction to 10° Union firm Shortening 1 cm (Class II)

5 Chas M, 35 yrs, December, 1905 Examination 2-10-'08
No perceptible limp Shortening 2 cm Flexion normal, rotation normal, hardly any abduction possible Was treated by longitudinal and lateral traction (Class I)

6 Margaret B, 50 yrs, January, 1907 Examination 2-10-'08
Uses cane on street Marked limp without cane Eversion slight, rotation fair, abduction and flexion normal Union firm Shortening 2 cm Was not brought to hospital until 5 weeks after injury in 1907 (Class III)

7 Jane C, 65 yrs, March, 1907 Examination 5-13-'08
Moderate limp, no disability, good union Found at her home housecleaning, and moving furniture around (Class II)

8 Lena M, 56 yrs, February, 1907 Examination 1-23-'08
Habitually uses two crutches, but can walk with only one cane Very little limp when using cane Goes up and down stairs easily Firm union Shortening 4 cm (Class III)

9 Eliza K, 70 yrs, June, 1905 Examination 4-2-'08

Slight limp, no cane Goes up and down stairs often each day, but not leg over leg Eversion slight, rotation slight, abduction to 18° , flexion to 90° Union firm. Shortening 1 cm (Class II)

10 Pauline T, 55 yrs, January, 1906 Examination 3-23-'08 Decided limp, uses one crutch on street, one cane at home Goes up and down stairs constantly, uses sewing machine all day, working it with either foot indifferently Rotation good, flexion to 90° , abduction to 20° Union firm, shortening 2.5 cm Was treated by longitudinal and lateral traction (Class III)

11 Anna C, 35 yrs, March, 1906 Report 5-13-'08 Marked limp, moderate outward rotation, perfect use (Class II)

12 Charles W. S, 70 yrs, June, 1906 Examination 4-20-'08 No limp, no disability of any kind All functions normal No shortening X-ray showed fracture through base of cervix (Class I)

13 Mary G, 58 yrs, October, 1906 Examination 5-16-'08 Moderate limp, flexion to 90° , slight eversion Union firm, shortening 5 cm Scarcely any disability (Class II)

14 Jane McC, 78 yrs, May, 1905 Examination 5-20-'08 Very little limp, scarcely any disability Union firm No eversion Shortening 2 cm (Class II)

15 Margaret G, 80 yrs, December, 1905 Report 5-20-'08 Died about three weeks after discharge, never left bed after return from hospital Recorded in hospital records as "unimproved" (Class IV)

16 Joseph S, 62 yrs, August, 1905 Report 5-23-'08 Moderate limp, always uses cane Works as watchman (Class III)

17 Catharine B, 63 yrs, November, 1907 Report 5-23-'08 Scarcely appreciable limp, no disability at all Fracture was impacted (Class II)

18 John B M, 15 yrs, October, 1906 Examination 4-20-'08 No limp, flexion to 15° beyond right angle, abduction 5° , shortening 2.5 cm Typical case of traumatic coxa vara (Class I)

19 Joseph K, 68 yrs, July, 1907 Examination 4-20-'08 No appreciable limp, slight eversion, flexion to 15 degrees beyond right angle, abduction 10° Shortening 0.75 cm Works as blacksmith (Class I)

20 Maxwell L, 78 yrs, October, 1907 Report 4-20-'08
Incapacitated, unable even to use crutches (Class IV)

21 Lydia L, 75 yrs, April, 1905 Report 5-28-'08 Died
of pneumonia in January, 1907, nearly two years after fracture
of hip Until within a few days of death walked with scarcely
appreciable limp, and with no disability (Class II)

THROUGH OR BELOW TROCHANTERS

1 Gottlieb F, 45 yrs, December, 1905 Examination
5-16-'08 No limp, no deformity Shortening 1 cm (Class I)

2 Carrie M, 12 yrs, June, 1906 Examination 5-16-'08
No limp, no shortening Treated on double inclined plane
(Class I)

3 Thomas H, 60 yrs, August, 1906 Examination 5-13-
'08 No limp, no disability Had double fracture of femur
(Class I)

4 Daniel H, 40 yrs, May, 1907 Examination 4-20-'08
Moderate limp, works as rigger at Cramp's shipyard, climbs lad-
ders constantly Upper fragment slightly displaced forward
Shortening 4.5 cm (Class II)

5 Joseph Q, 57 yrs, September, 1906 Examination
4-20-'08 Limp not noticeable, flexion to 15 degrees beyond
right angle Shortening 1 cm (Class I)

6 Bernhard P, 43 yrs, March, 1905 Examination
2-6-'08 No perceptible limp, rotation slightly restricted, all
other functions normal Slight thickening through trochanters
Shortening 2.5 cm (Class I)

7 Joseph S, 69 yrs, December, 1905 Report 5-13-'08
Very slight limp, all functions normal (Class II)

8 Susan D, 70 yrs, July, 1907 Examination 1-4-'08
Walking with cane, slight limp Had fractured same femur
three months before admission for recent refracture (Class III)

9 Annie D, 65 yrs, March, 1906 Examination 5-23-'08
Walks around house without crutch, goes up and down stairs
several times daily Marked limp Shortening 4.5 cm Had
also Pott's fracture of same leg, at same time as fracture of
femur (Class III)

SHIRT

1 Harry M, 6 yrs, September, 1905 Report 5-16-'08
No limp, all functions perfect (Class I)

2 Franklin C, 18 yrs, September, 1905 Examination 2-6-'08 Scarcely perceptible limp, all functions normal Shortening 1 cm (Class II)

3 Robert L, 53 yrs, October, 1905 Report 5-16-'08 No limp, no disability, wife cannot tell which was the injured side (Class I)

4 John B, 13 yrs, October, 1905 Examination 1-28-'08 No limp, all functions normal. Shortening 1 cm (Class I)

5 John R, 34 yrs, November, 1905. Examination 3-19-'08 No limp, all functions normal except flexion of knee, which is impossible beyond 35 degrees more than right angle Shortening 1 cm Some callus at site of fracture, which was comminuted (Class I)

6 Harry D, 7 yrs, February, 1906 Examination 3-19-'08 Very slight limp, all functions normal No shortening Limp probably due to fracture of lower third of leg bones on same side, sustained since recovery from fracture of femur (Class II)

7 Geo M, 54 yrs, May, 1906 Examination 5-16-'08 No limp, all functions normal No shortening (Class I)

8 Fred K C, 41 yrs, June, 1906 Examination 4-18-'08 Slight limp, all functions normal Shortening 0.5 cm Had same hip injured again shortly after discharge from hospital (Class II)

9 Benjamin S, 27 yrs, August, 1906 Report 5-16-'08 Slight limp, all functions normal (Class II)

10 John K, 15 yrs, January, 1907 Examination 4-18-'08 No limp, all functions normal Shortening 1.5 cm Was crushed in elevator, sustaining contusions of pelvis, fractures of left femur, and of middle third of both bones of left leg (Class I)

11. John M, 43 yrs, November, 1906 Examination 5-16-'08 Slight limp, all functions normal, shortening 2 cm Had also fracture of olecranon (Class II)

12 George D, 53 yrs, November, 1906 Examination 4-18-'08 Slight limp, flexion of hip only to 10° beyond right angle, all other functions normal Shortening 1 cm When 7 years of age had extensive operation on this femur for osteomyelitis (Class II)

13 James H, 10 yrs, May, 1907 Examination 4-21-'08 No limp, all functions normal Shortening 1 cm (Class I)

14 William H, 30 yrs, June, 1907 Examination 5-13-'08

No limp, all functions normal Shortening 0.5 cm Had also fractures of both forearms, compound comminuted of left; concussion of brain, and delirium tremens (Class I)

15 Albert F, 4 months, September, 1907 Examination 4-21-'08 No deformity, functions all normal No shortening (Class I)

16 John F, 15 yrs, October, 1907 Examination 4-23-'08 No limp, all functions normal Upper fragment is displaced slightly outwards Shortening 1.5 cm (Class I)

17 William M, 49 yrs, November, 1904 Report 5-18-'08 Committed suicide one year ago Still had slight limp, but no other disability (Class II)

18 Annie K, 70 yrs, December, 1904 Examination 5-18-'08 No limp, no disability Shortening 1 cm (Class I)

19 John S, 8 yrs, May, 1907 Examination 5-18-'08 No limp, all functions normal Shortening 1.5 cm (Class I)

20 Joseph C, 5 yrs, November, 1907 Examination 5-18-'08 No limp, all functions normal No shortening (Class I)

21 Joseph G, 16 yrs, March, 1906 Report 5-23-'08 Very slight limp, no disability at all Same femur broken twice (Class II)

22 Marie K, 2 yrs, August, 1906 Examination 5-23-'08 No limp, all functions perfect No shortening (Class I)

SUPRACONDYLAR

1 Ungar D, 29 yrs, July, 1905 Report 5-16-'08 Had slight limp two years ago (Class II)

2 Samuel M, 44 yrs, September, 1905 Examination 1-30-'08 Scarcely perceptible limp, full extension, but flexion only to 10 degrees beyond right angle Shortening 3 cm This was a fracture through the external condyle, involving the knee-joint, and the patient had had a fracture through lower third of same femur five years before this injury (Class I)

3 Arthur D, 7 yrs, January, 1906 Examination 3-19-'08 No limp, not quite complete extension of knee No shortening This was a compound epiphyseal separation (Class I)

4 Nellie S, 27 yrs, February, 1907 Examination 5-16-'08 No limp, flexion of knee only to right angle, all other functions

normal Shortening 2 cm This was a fracture of external condyle, involving joint (Class I)

5 Mrs W, 63 yrs, March, 1907 Examination 5-13-'08
Marked limp, no disability Shortening 3 cm (Class II)

6 John D, 45 yrs, December, 1907 Examination 4-21-'08
Marked limp, all functions normal Lower fragment is posterior and external. Wears heel three-quarters of an inch high Shortening 4 cm. (Class II)

7 William M, 65 yrs, April, 1905 Examination 5-20-'08
No limp, no disability Shortening 5 cm (Class I)

8 Hannah C, 62 yrs, May, 1905 Examination 5-20-'08
Crippled by rheumatoid arthritis in knees and hips, barely able to walk; has not been out of house since return from hospital Does no work Right knee is more stiff and disabled than the fractured knee (Class IV)

9 James McC, 55 yrs, October, 1906 Report 5-20-'08
Incapacitated, still uses one crutch and cane This fracture involved knee-joint, and the patient had previously had a fracture of cervix of same femur, which had united with shortening and deformity. (Class IV)

NON-TUBERCULOUS OSTEOMYELITIS OF THE OS CALCIS

BY JOHN G. SHELDON, M.D.,
OF KANSAS CITY, MO

IN this paper no distinction is made between osteitis and osteomyelitis. The word osteomyelitis has been selected to cover all non-tuberculous inflammations involving the calcaneum.

History—In 1814 Monteggia excised the os calcis for osteomyelitis and, so far as I am able to learn, the affection had not been given consideration previous to that time. Then for 45 years osteomyelitis of the os calcis does not seem to be mentioned in medical literature. In 1859 Polailon¹ discussed the condition from clinical and pathological standpoints, and, in the same year, M. Sedillot² elaborated its operative treatment. In 1870 Burrall³ reported a case treated at Bellevue and Fergusson⁴ reported one case in 1874. During the years 1876, '77, and '78, three articles were published regarding osteomyelitis of the os calcis. Vincent⁵ discussed its operative treatment, Lebecq⁶ reported a case in an adult who had sustained no injury to the part, and Schinzinger,⁷ who wrote the most exhaustive article I have been able to find on this subject, reported six cases. Since 1878 Zwicke,⁸ Owen,⁹ and Senn¹⁰ report one case each.

Frequency—Osteomyelitis of the os calcis is, according to medical literature, a rare condition. Although it has received little attention, it is probable that it occurs more frequently than the reports would indicate. Schinzinger believes that it is not so very rare and says that Ollier knew of 100 cases occurring in 16 years. I have treated 3 cases, and have knowledge of 2 treated successfully but not reported. T. Holmes and M. Markal state that many cases of caries, limited to one bone of the tarsus, are seen especially in children.

Etiology—Osteomyelitis of the os calcis is as a rule a disease of childhood. Of the reported cases only one (Lebecq's) occurred in an adult. It is found most often between the ages of 6 and 10 years, and, according to Owen is very rare after puberty. It is most often secondary to wounds of the heel, but as in Lebecq's case it may occur unassociated with injuries or local infections. The location and anatomy of the os calcis are factors predisposing to inflammatory involvement of this bone. It is the largest of the tarsal bones and, bearing most of the weight of the body, is exposed to traumatism.

The os calcis, during childhood, may be considered as a diaphysis of spongy bone having a posterior cartilaginous epiphysis. Ossification begins about the tenth year, the two parts of the bone uniting shortly after puberty. Several moderately large arteries and veins enter and leave the os calcis,—especially on its inner side,—affording an opportunity for infection in the soft structures of the heel to invade the bone. It does not seem probable that the lymphatics play an important part in the occurrence of osteomyelitis of the os calcis.

Pathology—The pathology of osteomyelitis of the os calcis does not differ from that of the same disease in other bones. While it is most often secondary to local infection, it occurs without previous local changes (Owen and Lebecq), and may be a part of infection involving many bones (Owen). Sequestration is the rule, but no sequestra may be found in children under 7 years of age. In patients from 10 to 12 years old one or two large sequestra are frequently found. They are more or less globular and measure from one-half to three-quarters of an inch in the longest diameter. In the museum of St Bartholomew's Hospital (Sp No 195) there is a specimen of osteomyelitis of the os calcis with a large sequestrum. In advanced cases the entire substance of the bone is destroyed, leaving only a thin periosteal shell. But even in these cases regeneration from the periosteum will in time, if the infection has been terminated, apparently completely replace the bone,

diminishing the deformity and rendering the foot functionally perfect

The bacteriology of osteomyelitis of the os calcis has not received attention. In the 3 cases that I treated, sinuses had formed and mixed infection was present.

Symptoms—The symptoms of osteomyelitis of the os calcis are the general symptoms of a septic infection associated with local manifestations referred to the heel. The general symptoms vary greatly in their intensity. In the early stages a sudden onset with a marked chill, high temperature, rapid pulse-rate and evidences of profound intoxication may be associated with moderate pain and tenderness only with deep and continuous pressure over the heel, while the local pain and tenderness may be marked and the general symptoms comparatively mild in the cases in which the infection is less virulent.

For practical purposes the symptoms of osteomyelitis of the os calcis may be divided into two classes (1) those complicating wounds of the heel, and (2) those in which the heel has not been injured. In the cases unassociated with wounds, the os calcis may be involved alone, or multiple osteomyelitis may be present. Lebecq reports the case of a man who had pain in the heel and later developed septic symptoms. There was no swelling, oedema or redness over the os calcis. No wound was present, neither was there a history of injury. After being septic about 9 weeks the patient died. Shortly before death an abscess developed in the heel but it was not drained. Postmortem showed osteomyelitis of the os calcis with a sequestrum as the cause of the sepsis. In this class of cases it is to be expected that pain would be marked in the early stages, that swelling, redness and superficial tenderness would occur only after the inflammatory process had extended from the bone to the soft structures, that the formation of a communication between the bone-marrow and the soft structures would markedly diminish the pain, and that spontaneous drainage to the surface would relieve both the local and general symptoms.

Owen reports a case of osteomyelitis in which the ulna, tibia and os calcis were simultaneously involved. In cases of multiple septic osteomyelitis it is well to keep in mind that the os calcis may become involved, and, as Kirmissen has said, osteomyelitis may affect any bone in the body.

In the cases of osteomyelitis of the os calcis following wounds there is a disproportion between the general septic symptoms with pain in the heel and the local swelling with superficial tenderness. The pain may be intense and the toxæmia marked while the tenderness and swelling are slight. Such a condition progresses in severity until artificial or spontaneous drainage is secured. Then the local and general symptoms suddenly improve markedly and a discharging sinus remains. Vincent says that 5 per cent of these cases die if untreated or if proper surgical treatment is unduly delayed. It is probable that osteomyelitis of the os calcis, like osteomyelitis in other bones, may occur in all degrees of severity. Schinzinger says that the affection may be so mild that it does not result in necrosis.

Diagnosis —What has been said regarding symptomatology indicates the factors that speak for or against the presence of osteomyelitis of the os calcis. If the condition has at times been overlooked, I believe it has been because it was not thought of rather than from inability to recognize it from the signs and symptoms obtainable. Septic or rheumatic involvements of the ankle-joint result in more diffuse swelling, and the anterior ligaments of the ankle are tender and present a fulness not found in disease of the os calcis. Movement of the joint increases the pain in diseases of the ankle, while this is not the case in osteomyelitis of the heel. Tuberculosis of the ankle-joint, or tarsal bones, may present difficulties in diagnosis. Tuberculosis is, as a rule, less intense at the beginning, it results in more atrophy and contracture of the muscles of the leg, and may be associated with general symptoms and findings that plainly indicate tuberculosis. The greatest difficulty in making a diagnosis of osteomyelitis of the os calcis is presented when diffuse acute infection complicates wounds in

the region of the heel In these cases it may be impossible to tell whether the bone is, or is not, involved If the changes in the soft parts are marked, and the general symptoms slight, the bone is probably not diseased If the local and general symptoms are severe, and there is no drainage, the bone is likely to be healthy But with free drainage from the soft parts, associated with marked general symptoms, the bone may be expected to be involved If no drainage is present and a diagnosis cannot be made, incision of the soft parts should be first done and if this is not followed by marked relief the bone should be explored without delay In the chronic cases, with sinus-formation and persistent discharge, the diagnosis is all but positive The X-ray may be of value in recognizing this condition

Treatment—Osteomyelitis of the os calcis is a surgical disease, and its treatment should be operative In the acute cases, the operation should be done early and should consist of drainage into the bone-structure In the chronic cases all necrosed and diseased osseous tissue should be removed, leaving the periosteal shell If the tendo Achillis has not already become separated from the calcaneum,—as it was in Senn's case and in one of my cases,—it should be lengthened and the foot dressed at a right angle The bone-cavity should be packed or filled with a Mosetig-Moorhof plug Although circumstances prevented the use of the plug in the cases herewith reported, it would seem to be indicated in operations for the chronic forms of this disease

Operative Treatment—So-called excision of the os calcis has received considerable attention Sédillot's subperiosteal method is recommended by Holmes, Erichsen, Southam, Vincent, Ollier and others The method of exposing the bone should be governed by the position and number of the sinuses in the soft parts The inner or outer lateral straight or curved incisions are ample Ollier made a lateral flap Erichsen used an elliptic plantar flap Holmes, Southam, Lund and others recommended various side incisions It is sufficient to say that in these operations all necrotic bone should be removed and the periosteum left

FIG 1



Osteomyelitis of os calcis Photograph of foot in Case III

FIG 2



X ray of foot in Case III

CASES

SENN reports one case of osteomyelitis of the os calcis occurring in a "little boy" Subperiosteal resection was done and the tendo Achillis detached More than one half of the bone was reproduced at the end of two months The patient walking without the use of a cane or crutch. Previous wounds or injury are not mentioned

FERGUSSON (Lancet, 1874, 1, 10) reports one chronic case of osteomyelitis of the os calcis with sinus formation and sequestration The sequestrum was removed and the patient recovered The report is very brief and incomplete

ZWICKE (Charité-Annalen, 1881, viii, 478) merely describes a central necrosis of the os calcis in a boy 12 years of age The bone contained a cavity the size of a hazel-nut filled with a fungous growth Two operations were required to effect a healing

OWEN (Lancet, 1897, 1, 37) reports a case of a boy 7 years old who had suffered for two years with osteomyelitis of the radius, ulna, tibia and os calcis Multiple bones were operated upon The os calcis was curetted and found to contain a pea-sized sequestrum The boy improved rapidly but was still in the hospital two weeks after the operation had been performed

LEBECQ (Bull de la Soc Anatom de Paris, 1887, iii, 55) reports a case of osteomyelitis of the os calcis occurring, without injury, in a man 44 years old In this case chronic pain in the heel became acute, septic symptoms developed and resulted in death An abscess formed over the os calcis but it was not drained Postmortem revealed pus and a sequestrum in the os calcis

SCHINZINGER⁷ reports 4 cases of chronic osteomyelitis of the os calcis "Some had a history of an injury," in all sinuses and sequestra were present Subperiosteal resection resulted in a cure in each case

CASES OBSERVED BY AUTHOR

CASE I—During the summer of 1902, Carl J, of Montrose, Colo, jumped on a rock, cutting his left heel About one week later he was suffering from pain in the heel and fever There was marked swelling, and a discharge of pus from the wound The local and general symptoms increased in severity for 10 days, then the pain became less and an abscess developed on the inner side of the heel This was incised Marked relief followed I saw the boy two months later His general condition was fairly good temperature normal Two discharging sinuses were present on the inner side of the heel These were connected by an incision, the two openings in the bone enlarged, two pea-sized sequestra extracted, and necrotic osseous tissue removed with

a curette The wound was packed, the tendo Achillis divided in sections, and the foot dressed at a right angle to the leg In three months the wound had healed and the boy could walk Two years later the foot was apparently normal except for the presence of the superficial scars

CASE II —In 1905, a boy of 8 years stepped on a nail, wounding the right heel At the end of three weeks his temperature was 103, and the heel painful and swollen The family physician made a liberal incision over the inner side of the os calcis, evacuating pus Two months later a sinus was present, extending into the bone The os calcis was necrotic but no sequestrum was found The dead bone was removed with a curette, the wound packed, and the foot dressed at a right angle to the leg The wound healed in four months One year later the foot was functionally normal

CASE III —Frank G, aged 11, in August, 1907, cut his right heel by stepping on a piece of glass Infection followed, and superficial incisions were made An abscess opened spontaneously in September, 1907, but the heel remained painful, tender and swollen Operation was done November 15, 1907 Only a shell of the os calcis remained Two large sequestra were removed During the operation the tendo Achillis tore away part of the posterior periosteum of the calcaneum The bone-cavity was packed, and the foot dressed in the proper position In five months the healing seemed complete On June 5, 1908, the foot is functionally normal, and the deformity not marked The photographs are of this case

BIBLIOGRAPHY

- ¹ Polailon, Arch Gen de Med, Sept, 1859
- ² Sedillot, Lancet, Dec 10, 1859
- ³ Burrall, Boston and Charity Hospital Report, 1870, 91
- ⁴ Fergusson, Lancet, 1874, 1, 10
- ⁵ Vincent, De l'ablation du calcaneum, Paris, 1876
- ⁶ Lebecq, Bull de la Soc Anatom de Paris, 1887, 111, 55
- ⁷ Schinzinger, Arch f klin Chirurg, Berlin, 1878, 22, 461
- ⁸ Zwicke, Charite Annalen, 1881, v, 8, 478
- ⁹ Owen, Lancet, 1897, 1, 37
- ¹⁰ Senn, International Clinics, 1904, 4

SILVERIZED CATGUT—THE ARGYROL METHOD

THE USE OF ARGYROL IN ITS PREPARATION

BY THEODORE R. MACCLURE, M.D.,
OF DETROIT, MICHIGAN,
Surgeon to Solvay General Hospital

DURING the last eighteen months, following a visit to the clinic of Cr  d  , in Dresden, I have used catgut which I have prepared with a ten per cent solution of argyrol. The method is as follows

Catgut is purchased in the ordinary five yard length, it is then cut into strands eighteen inches long, these lengths are then placed in a basin of sterile water to slightly soften the gut and make it more easy to handle

The gut may be made into little coils by winding around the first two fingers, the last one inch being twisted around the little coils to hold them together. This is not recommended as the gut is liable to snarl

Three-eighths glass tubing may be cut into one-inch lengths, the ends being carefully annealed. The gut may be wound around these little tubes so that the first lap or two will hold the starting-point firmly, and the last end can be held by a half-hitch around the tube (I use the tube instead of the rod in order to have less weight and allow the solution to circulate more freely in the receptacle or jar containing the gut under preparation)

The gut is now soaked in the ten per cent solution of argyrol made up with distilled water, for ten days. I have used one-quart jars, having wide mouth and ground-glass stoppers

After labelling the jar with the size of the gut and the date on which the process is started, it is my custom to envelop it in a sterile towel, pinned to hold it in place, and to protect it from the dust and strong light. Each day the jar is agitated

slightly in order to keep the argyrol more completely in solution

At the end of ten days the jar is gently shaken each hour for several hours previous to the time planned to take the gut out of the solution, in order to mix well any portion that may have settled on the tubes of gut or at the bottom of jar. A piece of sterile gauze is placed over the mouth of bottle, the bottle turned upside down over a sterile funnel in order to keep the tube from coming out and to save the solution that it may be returned to the stock receptacle for future use. An irrigator filled with sterile water, or sterile glass tube, is used to wash the gut in order to free it of any superfluous argyrol solution. This is done by letting into the jar some of the sterile water, shaking the jar gently in order not to detach the gut from the tubes. This process is repeated several times until the wash-water comes away clear.

The gut is then stored in pure alcohol where it can be kept indefinitely. The alcohol tightens the gut on the tube so that it is not easily detached although it is easily removed from the tube when you wish to use it. The gut is now ready for use after an hour or two in the alcohol.

In October, 1907, Dr Charles T McClintock, Director of the Biological Department of Parke, Davis and Company, examined several samples of this gut and found it to be sterile. Practical experience has demonstrated its sterility.

It is my opinion that catgut prepared with argyrol is an ideal gut and is not only thoroughly aseptic but is antiseptic and has the tenacity of the original gut. I have used it in various kinds of surgical cases, have used it in many abdominal operations, have used it almost universally in closing deep wounds layer by layer, and it has been especially satisfactory as a skin suture using the number "0" or the number "1."

Its use as a skin-suture has been not less satisfactory than has been my experience during the past several months in its use as a buried suture, the results from its use have been practically perfect, better to my mind than any other suture material.

The advantage of the argyrol solution over the collargolum¹ is that it does not precipitate so readily, and its power to penetrate into the centre of the strand is greater. It cannot be said that its aseptic qualities are any greater than that prepared with collargolum although I like its practical application better and when used for skin suture I believe it is much more satisfactory.

From my experience with the various methods of preparing catgut, I believe the argyrol method is entirely practical, is extremely satisfactory, and is recommended for its simplicity.

NOTE—In a communication received from Professor Cr  d  , dated February 22, 1908, he states that he now prefers to prepare silver catgut with silver lactate, actol, which he considers to be easier to prepare, more stable, and more antiseptic. His technic is as follows:

Raw catgut, just as it is received from the manufacturer, is wound on a glass reel and submerged in a one (1) per cent solution of actol, in which it is left for one week, the glass jar in which it is placed being wrapped with cardboard to keep out the light. After eight (8) days, the solution is poured off, the open jar covered with four (4) thicknesses of gauze, and exposed to the light until the strands have turned black, distilled water is then repeatedly poured over the catgut in the jar until the water remains clear. The jar is again covered with four thicknesses of gauze and stood in a warm place until it is thoroughly dried out, then it is closed with a cover, for it is ready for use, not having been touched with the fingers during the process of preparation. Before using, a reel is placed in a dish containing 60 per cent alcohol, out of which it is used during operation. Strong alcohol makes it too stiff and less firm.

¹ Blake, *Annals of Surgery*, 1907, xlv, 110

SURGICAL PROGRESS.*

GENERAL SURGERY, PATHOLOGY AND THERAPY

I Operative Interference in Embolism of the Pulmonary Artery

F TRENDELENBURG, of Leipzig, said the first thing to be considered was whether those conditions could be fulfilled, with regard to operative interference in cases of emboli of the pulmonary artery, which would justify the application of surgery, that is to say, whether the diagnosis of embolism can be ascertained with sufficient accuracy and whether there is sufficient time for an operation

The first question, he concludes, can be answered in the affirmative, although, individually, the symptomatology is complex, in their entirety they give a certain characteristic picture, usually the well-known symptom-complex of sudden collapse, pallor, lividity of the lips, loss of pulse, together with deep and distressed respiration. Generally the diagnosis will be strengthened by minor indications, either through a previous operation in which the larger veins were exposed or ligated, or because of an evident thrombosis of the femoral or other veins, or by fracture of one of the lower extremities, or by varicosities. Auscultation of the heart generally gives a negative result, systolic, or systolic and diastolic murmurs may be interpreted as an evidence of the fact that the embolism is in the right heart

With regard to the second question, he states that death by no means results as suddenly as is generally supposed. In reviewing nine cases of embolism occurring in the Leipzig Hospital, he found that only two succumbed very suddenly,—in from one to two minutes. In the other seven cases, an interval

* Excerpts from the Transactions of the GERMAN CONGRESS OF SURGERY, held April 21 to 24, 1908. Translated by JAMES TAFT PILCHER, M D, and WOLFGANG JOERG, of Brooklyn, N Y, from the abstracts published in the Beilage zum Zentralblatt für Chirurgie, No xxxv, 1908

varying from ten minutes to an hour elapsed before the patients died, with at least one-half of the cases it was found that as much as fifteen minutes would have been at the disposal of the operator, that is to say, enough time for an operation in a hospital

The technic of the operation was demonstrated on a corpse, and corresponds to the technic given in the *Zentralblatt* No LV, 1908 Briefly stated, the facts are that the pulmonary artery lies in the second left intercostal space and is covered by the pericardium, and behind it lies the superior vena cava Experimentally, he has established the facts that complete compression of the pulmonary artery can only be tolerated, at the longest, forty-five seconds to two minutes, beyond that, death occurs Partial compression, is possible, for several minutes Compression of the superior vena cava can be borne for at least ten minutes, according to Sauerbruch Presumably the venous plexus of the heart supplies the right heart and the lesser circulation with blood when the vena cava is compressed, while, on the other hand, when the pulmonary artery is compressed, all blood is cut off from the lungs Simultaneous compression of the pulmonary artery and aorta has the same effect as that produced by compression of the pulmonary artery alone

It is, therefore, necessary that the emboli be extracted as soon as possible after the compression and incision of the pulmonary artery, forty-five seconds should suffice for such a simple procedure There is, however, no objection to compressing the artery laterally if one needs more time, then to release the pressure and allow the circulation to be resumed, then recompress, and continue the search for the branches of the pulmonary artery which contain the emboli

A transverse incision on the second rib, and a vertical incision on the left side of the sternum, are to be preferred to the flap incision for opening the thorax The part of the second rib adjacent to the sternum is resected for 10 to 12 cm, a vertical incision is made through the pleura and into the pericardium at the level of the third rib The vessels here lie a little underneath the sternum, they are pulled forward and a rubber tube is passed behind the aorta and the pulmonary artery, and afterwards drawn upon After this procedure rapidity is essential, incise the pulmonary artery, pull out the embolus with a pair of forceps, and

immediately close the incision in the arterial wall with clamps, and, as before stated, using no more than forty-five seconds. The compression is then removed, and one can suture the artery and the soft parts at leisure.

Tiendelenburg, in referring to a previously published article—in reference to a calf which was killed four months after the removal of an embolus 15 cm long from its pulmonary artery—showed the specimen of the heart, on the inner side of the pulmonary artery the place of the incision could be easily recognized by a thickening and callousness on the intima, the silk threads which were included could not be discovered from the outside as they had been covered over by hyperplastic tissue. An attempt to apply this operation to a man seventy years of age was not successful, owing to death on the table. Since then he reports two cases which had been operated on in the surgical clinic at Leipzig (*Deutsche Zeitschrift für Chirurgie*, vol xcii, p 282, and *Deutsche Wochenschrift*, No xxvii, 1908) both of which cases proved the feasibility of this operation on man. The two patients, who had become pulseless during the operation, revived quickly after the extraction of the pieces of thrombus from the pulmonary artery, some of which were 34 cm in length, the loss of blood from the artery itself was very small. The first patient, however, died fifteen hours after the operation from heart failure. The second patient, also, died from a post-operative hemorrhage from the internal mammary artery, but survived his operation for thirty-seven hours. In a branch of the pulmonary artery an overlooked embolus was found, post mortem.

II Shortening the Treatment of Patients Subjected to Laparotomy, by Allowing Them out of Bed Early

KUMMELL, of Hamburg, after a historical review of the methods heretofore used, pertinent to allowing persons who have undergone operations, particularly those who have been subjected to laparotomy, to leave their beds earlier than is customary, discusses his experiences.

Since January, 1908, he has observed 164 patients who had left their beds on the first to the third day after the operation of these there were fifty herniotomies, eight Alexander Adams's, fifty-six appendectomies à froid, twenty appendectomies à

chaud, seven extirpations of ovarian cysts, four myomectomies, salpingectomies (pyo-salpinx, ectopic gestations), three cholecystectomies, four entero-anastomoses, gastro-enterostomies, and exploratory incisions. The reason for diverging from the previous methods of having persons after being subjected to laparotomy keep to their beds for two to three weeks, was the experience of others that the chances of emboli are considerably diminished when as normal a condition as possible is brought about by having patients sit up as soon as possible after the operation, and allowing the action of the heart and other organs to correspond as nearly as possible to normal conditions. As a matter of fact, the experience of operators in this domain has demonstrated a considerable diminution of embolic and thrombic sequelæ.

Among the 164 cases which Kummell considers, there is only one unimportant thrombosis and no embolic occurrences, while according to the old method, in the year 1906-7, with almost the same number of laparotomies that is, 600, about one per cent of these died from the effects of thrombosis and embolism. The author sees an advantage in the new method that is not to be underestimated, viz, that the wounds heal more firmly than might usually be expected.

As a pre-requisite to the application of this method, Kummell designates

- 1 Perfect anæsthesia, without vomiting or other complications
- 2 Quick operation, small loss of blood
- 3 Primary union
- 4 Firm suture of the fascial planes

In this case, as in every other one of such eminent importance, judgment must be used, and adherence to one procedure for everything avoided. And here the valuation of the idiosyncrasies of the patient must be taken into consideration. He has not recorded, so far, any failures by this method, on the contrary it has proved itself efficacious (*a*) in that it diminishes the symptoms of disturbed intestinal activity which are so often disagreeable after laparotomy, (*b*) in that the subjective condition of the patient is ameliorated, (*c*) in that it promotes the recuperative powers, briefly, then, that it shortens the length of convalescence, and, above all, leads to a firmer cicatrization.

III. The Spark Treatment of Cancer.

V CZERNY, of Heidelberg, remarks that four-fifths of his patients are suffering from inoperable carcinoma. For this reason the method of treatment as suggested by Keating Hart was used as a last resort. The apparatus can be joined to the Rontgen coils, of which one uses the inductor and Wehnelt current interrupter. The electricity is conducted to a petroleum condenser which is fitted with spark and solenoid interrupters, the latter being in connection with the Oudin resonator, a copper spiral of 130 turns which by means of a lever controller, is so attuned to the solenoid that from its upper pole through a metal electrode, sheafs of sparks of 10 to 20 cm. in length will be emitted. These sheafs of sparks, which are cooled in a stream of carbon dioxide or compressed air, are directed from five to forty minutes on the carcinoma and its vicinity in various directions, while the patient is in deep narcosis.

Then the carcinoma is extirpated or curetted, the hard border cut off with a knife, and the surface again subjected to the sparks for ten to fifteen minutes, in order to destroy the remaining carcinomatous nests. The action of the spark discharges seems to cause a destruction of the carcinoma cells and also of the intervening tissue if it is soft, tough scirrhous tissue or healthy skin resists long exposure, but are eventually changed to a burnt scab.

Deep-seated carcinomas are best extirpated by the usual surgical procedures, and the surface then subjected to the sparks. Especially when the first operation is for recurrence, or if the condition of the tumor makes recurrence likely. There is a good deal of subsequent secretion from the surfaces so treated, and the parts must be well drained or treated openly with tampons.

Czerny reports from November, 1907, to April, 1908, 120 such treatments. The fulgurations were used on fifty-nine patients, of these, four were sarcomas, in which one may naturally expect better results than in carcinoma, the results of the latter can not as yet, of course, be permanently stated. But of these cases several are improving, seventeen have died, eight facial carcinomas have been cured, some have had relapses into their former condition after short periods of improvement. The treatment seems to be most useful in the superficially ulcerated, and

particularly in the soft carcinomas. It stimulates rapid cicatrization and granulation, and is certainly more efficacious than the Rontgen ray or radium, although they should not be neglected as accessories.

IV. Remarks Concerning the Technic of Transplanting the Thyroid Gland.

KOCHER, of Bern, reports on several successful cases of attempts to graft thyroid tissue onto bone (the tibia), a process which obtains just as certain results and is simpler and less dangerous of execution than, for instance, the former procedure of transplanting into the spleen.

In discussion of the above paper, Payr, of Greifswald, states the further course of the case of thyroid transplantation into the spleen, referred to two years ago in the Surgical Congress. Since the operation, twenty-eight months have passed, a period which suffices to allow formation of a judgment on the result of the transplantation into that organ.

It had been a very unfavorable case, in which the speaker had transplanted a large piece of maternal gland into the spleen, the child had for three years previously been treated internally with various thyroid preparations, with little success. In spite of the lack of results in this former treatment, after the transplantation, the intellectual and somatic condition of the child had improved in a remarkable degree during the first months and to the end of the first year, after that, somewhat more slowly. With regard to the intellectual condition of the patient, Payr reports that the child was totally imbecile and animal-like in its entire disposition, it could neither stand, walk nor sit, it emitted inarticulate sounds and did not react to sensory impressions. All these symptoms improved remarkably. Growth and increase of weight were very evident. The X-rays were not used to observe the epiphyseal growth, on account of the injurious effect which they have on young bones. The child, since the fall of 1907, has not progressed much and has suffered repeatedly from intense catarrhal conditions, it has become very anemic and sallow and has developed a general glandular enlargement, including the spleen. The increase in weight has also dropped off, but the child now weighs 19,400 grammes (average weight of a child of eight years), the dentition, growth of hair, and nail develop-

ment are all normal, and the skin shows no evidence of the former myxodermatic changes. The position and carriage are not absolutely straight and the gait, in the last two months, has become spastic.

The later results have not come up to the promise given by the improvement in the earlier months, it is certain, however, that the child has shown no recurrence of its myxœdema, and we must deduce, therefore, that the gland transplantation is still in a viable condition. There were also many factors gravitating against the best interests of the child, that is, poor lodging, poor nourishment, bad air, light and care, the result, therefore, can not be considered a complete one. With our present-day knowledge it is probably of prime importance in which kind of case of hypothyreosis operation is performed, whether it be a case of congenital or acquired myxœdema, or cachexia strumipriva, or, finally, of a combination of cretinism with myxœdema. We know from the recent investigations of Scholz and Zingerle that in cases of cretinism important changes are evidenced in the central nervous system, especially in the cerebrum, and these are present in almost every case. In the combined cases of congenital myxœdema and cretinism, particularly in cases of somewhat older children, the chances of success of transplantation are, therefore, probably, very limited, because it seems doubtful if the cerebral defects caused by the lack of thyroid extract are capable of being reconstructed. The more recent the case, the better the success.

With reference to the technic, the spleen is especially adapted to receive the transplantation because of its highly developed vascularization. If it become evident that the marrow takes care of the nourishment of the transplanted tissue in the same way, then of course this method would prove much simpler and less dangerous.

GARRE (Bonn) transplanted, in a case of chronic tetany after goitre extirpation, a parathyroid which he had removed from a case of Basedow's, into the tibia, with marked improvement in the symptoms, but suggests that we should transplant entire organs by means of the vascular suture (Stich), if permanent results are to be obtained. This has been accomplished experimentally.

CZERNY (Heidelberg) extirpated an entire carcinomatous gland, and transplanted for the resultant tetany a fresh piece of gland in the spleen, with immediate improvement of the symp-

toms On autopsy, death having occurred from pneumonia on the sixth day, the thyroid implantation was found to be perfectly healed into the gland substance

MULLER (Rostock), in two cases of cretinism, has made transplantations into the tibia, with marked intellectual improvement Eiselsberg also reports two successful cases by this method, which had resisted all other procedure, and one other, in which he had not been successful because of suppuration

V Use of Free Bone Plastic and Attempts at Bone Transplantation.

LEXER, of Königsberg, 1 Pr, reports on his experiences with free bone transplantation based on many cases Those treated consist of replacing large gaps in the skull, of lifting sunken portions of the facial skeleton, replacing large defects in the long bones and the lower maxilla, cure of pseudo-arthritis including cases of neck of the femur, the bolting of bones, the stiffening of paralytic joints especially in the foot, of bolting adjacent bones including the head of a joint or including both epiphyses, and, finally, the transplantation of entire joints Formerly he used boiled and macerated bone and transplanted it underneath the periosteum, this was successful in small defects but not in large ones, the bone being usually extruded by suppuration.

In the cases now considered, he has been using material gathered from the abundant amputations of his clinic, for transplantations For this purpose he finds the fresh bone covered with periosteum best suited, while the old process served in most instances only where the bone had been transplanted under the periosteum into the bone itself in the case of large pieces to replace defects in the long bones As the marrow in the transplanted bone causes an inflammatory action accompanied by fever resultant from its destruction, he now clears this out and fills in the cavity with iodoform, by which means this inflammatory phenomenon of resorption has been obviated The gradual absorption of the filling is easily checked up by means of the X-ray and thus the continuation of the vascularization observed

Of interest in his report is a case in which for sarcoma of the upper third of the tibia, a transplantation was made to supply the defect caused by amputation including one-third of the bone

together with its articular surface. The result healed in and a relatively good functional joint was obtained. A similar case is noted in the resection of the upper end of the humerus.

Again, in a case of bony ankylosis of the knee, he substituted, after a section of the joint, an entire fresh knee-joint with cartilages and crucial ligaments, measuring from one to one-and-a-half cms on either side of the joint's surface. Seven months after the operation he reports that slight movement has resulted, and remarks that it was problematical whether good movement could ever be obtained.

VI A New Method for Local Anæsthesia in the Extremities

A BIER (Berlin) suggests that in order to perform operations on limbs which have heretofore been impossible to do without pain, under local anæsthesia, that the part to be anæsthetized should be isolated between two rubber bandages, one above and one below the part to be operated on, and should be spread over as large an area as possible without encroaching on the field. This is painless in contradistinction to the ordinary Esmarch operation. In the isolated part a vein is then picked up as close as possible to the proximal bandage, in the leg, the saphenous, in the arm, the cephalic, basilic or median. For the fore-arm the large superficial veins may be used. The procedure subsequently is similar to that used for an infusion, he injects between fifty and eighty c c of a 0.25 per cent or 0.5 per cent novocain. The part immediately becomes anæsthetic if the technic has been successful.

The anæsthesia is to be divided into two parts, first, the direct and immediate anæsthesia, and, second, the later or indirect anæsthesia, viz, one which occurs below the distal bandage, the operation should be done in the first stage. Soon after the second stage motor paralysis will be evidenced. Under this procedure the author has painlessly resected elbow and knee joints, done various amputations, sequestrotomies, and tendon implantations. Poisoning is avoided because of the artificial anemia produced, and owing to the constriction the novocain does not get into the circulation, and also because of its dilute solution. It is further obviated by first loosening the proximal bandage lightly to allow a primary circulation of the

arterial blood, the venous returns still in check, in order that the wound may so be washed out. The bandage is then tightened and is not loosened again until the end of the operation. Finally, the vein may be washed out through the cannula, with a physiological salt solution. The anæsthesia disappears immediately on loosening the proximal bandage.

HEAD.

I. The Operative Cure of Acromegaly by Removal of a Hypophysial Tumor.

J HOCHENEGG (Wien) reports the case of a patient thirty years old, in whom, on account of the very evident symptoms in conjunction with a Rontgen ray photograph of the skull, a diagnosis of acromegaly and tumor of the hypophysis was made. The acromegalic changes involved the head, face, hands and feet, the superior incisors were separated about half an inch, the disease itself seeming to have developed in two distinct parts. The patient remained normal up to the fifteenth year, between the ages of fifteen and twenty-five she became pale, suffered from intense headache, periodic attacks of perspiration, nose-bleed and cessation of menses. There soon developed a defect in the sight. After one year these symptoms disappeared, the menses returned and continued for four years, when they again became scanty in August, 1907, the headache returned, and under paræsthesia, enlargement of the hands and feet developed together with marked thickening of the lips, nose and tongue. The changes in the general disposition of the patient became so evident as to be easily recognized by her friends. The method used consisted in turning back the nose and reaming out the entire nasal cavity, until the apex of the cone so formed was situated at the bed of the hypophysis, after the method of Eiselsberg, Schlofer and Tandler.

The case further demonstrated that in acromegalic conditions the sinuses of the face, especially the frontal sinus, are very much enlarged, thus giving more room superiorly, if it be opened and cleared out in the course of the operation. On account of the subsequent defect in the anterior wall, two incisions were made in the line of the eyebrows, the bone chiselled through and then fractured, but not removed. The pharynx was tamponed in the

posterior nares, the wall of the sinus of Highmore and the internal orbital plate were left intact, the hemorrhage checked by tampons of adrenalin. On the final chiselling through of the sella turcica, a tumor—white and tense, the size of a hazel-nut—appeared at the apex of the cone, the dura was split, and the real tumor which then appeared soft and reddish-brown, swelled out into the wound under pulsation.

The growth was curetted until only the tough dura lining the cavity was felt, the cavity was then wiped out with adrenalin tampons. This was all done through an aperture about the size of a pea, this is a very good procedure as the danger of subsequent meningitis is minimized. The cavity was lightly tamponed with an iodoform wick, and iodoform gauze was gently packed into the nasal cavity through which the iodoform wick was led. The post-operative course was easy and free from complication. The drains were removed on the eighth day, and on the tenth day the patient was allowed up. Pathological diagnosis, adenoma of hypophysis.

The results are to be viewed from two separate aspects.

- 1 The headache stopped, the psychic condition immediately improved, the eyesight was much better. These three considerations can be looked at as the result of mechanical pressure; similar effects have also been obtained by other operators.

- 2 The greatest result, and the most remarkable, was the effect on the acromegalic condition, five days, post-operative, the patient subjectively remarked that the incisor teeth were approaching each other, that her jaws set differently, on the tenth day this change was very marked, and the hands were markedly diminished in size. One month later the patient was discharged. The foregoing signs had continued to improve, her feet had become greatly reduced in size, and her entire appearance was so changed that she was unrecognizable.

The divergent views on the importance and relation of hypophysial tumors with regard to their effect on the symptom-complex of acromegaly are interesting.

- I Hypophysial tumor is a partial phase of acromegaly, and is only one of the evidences of general enlargement.

- II Hypophysial tumor is the cause of the acromegaly, through the cessation of function of the hypophysis, or through

the increased function of the hypophysis, or through the qualitatively changed secretion

III. Hypophysial changes have a causal importance, but only for changes within the region of the head as being the part of the body connected with the cranial nerves

The author's case, which he states, is the first in which the operation was successful, may decide the question in particular, which influences are to be ascribed to hypophysial tumor in the genesis of acromegaly. The operation, however, viewed in the light of nothing but an experiment, seems to prove conclusively that hypophysial tumors have not only symptomatic but also etiological importance. It also proves that the acromegalic phenomena are caused not by a cessation of the hypophysial function but by a hyperfunction of the cerebral appendage, and proves further that the changes in the extremities are due absolutely to the hypophysial secretion.

H. BORCHARDT (Berlin) demonstrated a young man operated upon two months before for tumor of the hypophysis, exhibiting the symptoms of violent headache and visual disorders. The operation was done primarily through the frontal sinus, but while on lifting the frontal lobes the hypophysis could be reached, it was inaccessible to operation, and was accompanied by an alarming hemorrhage. A secondary operation was done through the nose and a partial resection of the tumor was accomplished, with the result that the headaches have stopped, and the maniacal attacks from which the patient had occasionally suffered have been relieved.

VON EISELSBERG (Wien) reports three cases operated on in January, 1907. The first case was a man twenty years old, who was operated on for a symptom-complex of headache, double hemianopsia temporalis, adiposity and defective development of the genitals. The X-ray gave a shadow of a tumor of the hypophysis. Operation, January 21, showed a cyst in the situation of the hypophysis, the pathological examination of which indicated an epithelial carcinoma. Result, the headache ceased, visual disorders were diminished, tendency toward corpulency inhibited, and at present the patient feels perfectly well.

The second case was a patient thirty-three years old, typical acromegaly. Eight years ago, while pregnant, noticed enlargement of hands, feet and face, had previously suffered

from headache and visual disturbances. X-ray showed a considerable enlargement of the sella turcica, in addition to which there was considerable enlargement of the lymphatic glands, and a chronic catarrh of the posterior nares and pharynx, because of which latter fact no operation was done. Later, however, the patient insisted that she be operated upon, this was done and a solid tumor removed. Two days later death ensued from meningitis. Autopsy disclosed a large basal tumor extending far under the frontal lobes. Pathological diagnosis, sarcoma.

The third case was a man twenty-six years old. For two years he had suffered from intense headaches, visual disorder and vertigo. Examination of the eyes gave a left hemianopsia and an atrophy of the right optic nerve. X-ray showed enlargement of the sella turcica. On operation, the tumor was removed by the usual nasal route, with the result that the headaches were stopped, and subsequent improvement of the optic conditions ensued. Diagnosis, sarcoma.

Referring to operative technic, Eiselsberg used the nasal flap approach with removal of the wall of the frontal sinus, but thinks that Hochenegg's idea would prevent the subsequent deformity, and states that the operation is certainly feasible, especially where the tumor is of a benign character. Care should be taken that the presence of diabetes is eliminated before operation on the tumor, as these two conditions are often dependent upon each other.

THE THORAX

I Intra-Thoracic Operations in Positive and Negative Atmospheric Pressure

H KUTTNER (Breslau) reports his experience during the past year in eighteen cases operated on according to the methods of Sauerbruch and Brauer. In nine cases he used the former's method of positive pressure, and in the other nine cases he employed the latter's apparatus for effecting negative pressure. The cases consisted of gunshot wounds, tumors of the chest wall, bronchiectasis, lung fistula, two primary lung cancers, and three carcinomas of the thoracic portion of the oesophagus. In all the cases the author decides that the methods independently of each other, may be employed to a very decided advantage, and tend to show a marked progression in the surgery of this region.

Considered physiologically, both methods seem to have an equal value, but he considers that of Sauerbruch much the more convenient, on account of the increased facilities which it offers to the operator.

ABDOMEN.

I. Gastro-Duodenoscopy and Diaphanoscopy.

THE ROVSING (Copenhagen) presents this method as an aid in a large number of those cases where the surgeon during the operation, after he has the stomach under direct vision and after thorough inspection and palpation, has not come to any definite diagnosis. The gastroscope is introduced into the stomach through an incision 1 cm in length on the anterior surface, it is inserted just above the greater curvature and approximately midway between the pylorus and the fundus. It consists of practically a greatly enlarged Nitze gastroscope, but with an apparatus through which air can be introduced for subsequent dilatation. The cut is made small enough so that the instrument, after its introduction, will render the stomach airtight after the application of a purse-string suture around its shank. The procedure consists now of two parts.

First, the diaphanoscopy, and second, the direct gastroscopy. Considering, then, diaphanoscopy. The lamp is lighted as soon as the stomach is sufficiently inflated, the distal end is then moved slowly and methodically over the entire stomach area, on which all the anatomical details of the walls have become astonishingly sharp and distinct, the blood-vessels, the course of the muscle-fibres in the different localities, etc. In order to procure the best results from the illumination it is found best to hold the lamp in the middle of the stomach and to observe its conditions in a perfectly dark or semi-dark operating-room. One can recognize very easily a gastritis from the strong red to deep bluish-red color of the walls, and also by the thickened and distended vascular net-work. Tumors are recognized by the dark, diffuse shadow on the otherwise clear stomach wall. In sharp contrast to this condition, one sees the deep chronic ulcer in the centre of a white, porcelain-like vascular-free portion which is contrasted sharply by a dark red zone. Small erosions or superficial ulcerations of the mucous membrane, if they are bloody or covered with a blood-clot, appear as dark spots on the wall, from which

a blood stream may be seen flowing in a dark streak down towards the greater curvature. After the examination of the stomach, the operator may pass the instrument through the pylorus and into the duodenum which is very brilliantly illuminated because of its thinner wall and because of the greater concentration of the illumination.

Second, gastro-duodenoscopy. When one has noticed by diaphanoscopy any abnormal place on the wall of the stomach, this he can then verify by looking through the gastroscope, and so appreciate the exact condition which exists, and in a few minutes he can examine the entire stomach mucous membrane from the cardia to the pylorus, and, further, the pylorus and the duodenum as far as the papilla, when no advanced pyloric stenosis interferes with the passage of the instrument. No abnormality can be concealed on the stretched mucous membrane.

In two cases where from the clinical picture the diagnosis could not be made between carcinoma and ulcer, on examination with this instrument the stomach was found perfectly normal, but severe ptosis was observed and a subsequent gastropexy proved that this was the cause of the symptoms and suffering. In nine cases, ulcers of the stomach were unexpectedly found, in three cases, ulcers of the duodenum were determined as having caused symptoms which were insufficient to determine the exact diagnosis, and in four cases, malignant growths were discovered. In one very important case a patient was undoubtedly saved, from a very severe hemorrhage caused by a very small erosion, which bleeding-place was discovered without danger through the method of diaphanoscopy.

The author also mentioned a specially constructed gastroscope which he used for retrograde introduction into and dilatation of the œsophagus, in cases of stricture which had been found impermeable from above.

The apparatus is easily disinfected by being placed for thirty-six hours in a formalin sterilizer.

In none of the twenty-five cases did peritonitis develop, and only two of the patients—who had advanced cancers—died, of pulmonary complications.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated meeting held June 1, 1908.

FIBROLIPOMA OF SYNOVIAL FOLDS OF KNEE-JOINT

DR. JAMES K. YOUNG presented a man, 21 years of age, who five years ago sustained an injury to the left knee from a fall on the ice. He exhibited the usual symptoms of synovitis, of which pain was an important and persistent feature, continuing until 18 months ago, when he came under Dr. Young's observation. At this time the knee was partially ankylosed, there was thickening and induration about the patella, with atrophy of the muscles, and pain was excruciating. An exploratory arthrotomy was undertaken to verify the diagnosis of villous arthritis. The incision was a subpatellar one dividing all the structures in the anterior portion of the joint. The condition was found to be a fatty degeneration of the subpatellar bursa and synovial fringes. The recovery was uneventful and the functional use of the joint is perfect.

DR. OSCAR H. ALLIS said he had had four or five somewhat similar cases, but in these he thought the grade of inflammation was greater than in that of Dr. Young's case, and that that might have possibly been the reason why his results had never been so good. He had gotten fairly good motion, but nothing so complete as in the case presented.

Instead of the incision below, as in Dr. Young's case, which calls for the division of the patella tendon, Dr. Allis prefers an incision above the patella, as he does not think there is quite the same risk with this incision. A good view of the whole joint is obtained by either of these incisions, which are elliptical, turning the patella up in one instance, and down in the other. Dr. T. G. Morton was the first to split the patella longitudinally and turn the lateral halves outward, but with this procedure he did not think one got as good a view of the joint.

TENDON TRANSPLANTATION FOR TALIPES VALGUS

DR YOUNG presented a girl, 12 years of age, who had paralysis of the tibialis anticus muscle with marked valgus, of seven years' duration. For three months prior to the operation the deformity had been increasing. The operation performed five months ago consisted in the transplantation of the peroneus longus into the tibialis anticus, the valgus having first been restored to normal position. The foot is now in a corrected position and its function normal.

PSOAS ABSCESS CURED BY POSTERIOR OPERATION

DR YOUNG presented a girl, 4½ years old, who was taken ill six months ago with incipient Pott's disease of the lower dorsal vertebræ. There was marked flexion of the thigh and psoas abscess was present. Four months ago the abscess was opened by a posterior incision, the so-called Treves operation. The abscess-cavity was curetted, the extremities of the wound were shortened by sutures, and drainage was maintained for only a very short time, the wound closing in seven weeks. The patient has now entirely recovered from the abscess.

LUDWIG'S ANGINA

DR JOHN W PRICE read a paper reporting five cases of Ludwig's angina. For this paper see page 649.

DR T TURNER THOMAS (by invitation) in discussing this paper said he believed that Ludwig's angina was more common than is generally supposed, but that these five cases occurring in one hospital within ten weeks made it appear more common than even he had believed. He thinks there is no doubt regarding the diagnosis in any of Dr Price's cases. In many cases, however, he says there is much confusion in the diagnosis, many being reported as Ludwig's angina which were simply cases of submaxillary cellulitis, because the patient could not open the mouth, had difficulty in swallowing, in speaking, and in handling the saliva. In every one of Dr Price's cases he thinks there are typical symptoms of the condition as described by Ludwig, which began in the submaxillary region, with possibly the exception of the second case, which began in the mouth and is of a different

and more dangerous type. It is worthy of note that this was the only case which died.

Dr. Thomas considers that the danger in this condition is in the invasion of the larynx, and is particularly present when the floor of the mouth becomes involved because the tissue in the floor of the mouth is loose and contiguous with the submucous tissue of the pharynx and larynx, so that when this tissue is once involved it takes but a short time before the larynx is infected. Therefore, any infection of this character beginning in this region is a very dangerous condition, and the more dangerous, usually, the nearer its origin is to the larynx. Take, for instance, the cases reported by Semon, these were of the kind which begin in the region of the tonsil or in the neighborhood of the larynx itself, and in these cases the mortality was very high. A large number of them developed trouble also in the lungs or pleura.

Dr. Thomas considers that the most important point in the treatment of cases of Ludwig's angina is to recognize the focus from which the process is spreading and attack that. He does not believe the tonsillitis, the carious teeth, or the little ulcer in the mouth is the essential focus in the majority of cases. In one case reported in the literature the mouth became dangerously infected from a wound inflicted by the kick of a horse, knocking out several teeth, and lacerating the floor of the mouth. In one of his own cases the trouble began in the floor of the mouth from a gunshot-fracture of the jaw. He believes the great majority of cases begin in the submaxillary region, and that this is due to the fact that the infection enters the system by the way of a slight focus somewhere in the mouth, and from there extends to the lymphatic glands in the submaxillary region, where the infection becomes more active and causes rapid and great trouble, that is the real focus of origin.

Dr. Thomas does not believe much in the importance of the deep fascia of the submaxillary region as a restraining structure. He has dissected rather a large number of necks, and after taking away the platysma myoides muscle he believes what fascia is left is very delicate and cannot be an important structure in holding the swelling down.

DR. G. G. DAVIS said that the bacteriological examinations in Dr. Price's cases, as in practically all of the other cases reported,

showed the character of the infection to be of varying type. His paper also shows that the point of infection is not the same in every case. It is interesting that in two or three of the cases the teeth proved to be the infecting point, and the question suggests itself, was it the injection of the cocaine by the dentist, or was it the pulling of the teeth which caused the inflammation to start up? In a case which Dr. Davis reported a lawsuit was threatened to prosecute the dentist for introducing the infection, whereas it is very well known that dentists, as a rule, object very seriously to pulling teeth or doing any operative procedures on the mouth when there is a marked inflammation of the structures.

Mention was made by Dr. Price of the lymphatics, and Dr. Thomas likewise referred to the lymphatics carrying the infection from the centre or interior of the mouth to the outside of the jaw in the submaxillary region. Dr. Davis has never thought that the infection was transmitted primarily by the lymphatics. However, in one of his cases Dr. Price mentioned that some of the lymphatics were involved. This is the first case in which Dr. Davis has ever heard of involvement of the lymphatics, as such, being recognized. In other words, although we have lymphatics in profusion along the deep vessels of the neck, yet we do not find isolated enlargement of lymphatic nodes, but we do find inflammation spreading along the cellular tissue.

Dr. Davis thought particular attention should be called to the treatment in the cases reported. He thinks their prompt recovery was due to the vigorous treatment which they received. The appearance of a patient with this condition is really alarming, and when these cases fall into the hands of general practitioners who are not proficient in severe surgical procedures, they are afraid to make such incisions as are demanded in such cases. The extent of the incisions demanded was well shown in some of Dr. Price's cases, in which he made an incision into the mouth from the outside in the median line, and likewise incisions on both sides in the submaxillary region.

THE CONSERVATIVE TREATMENT OF FRACTURES OF THE FEMUR

DR. A. P. C. ASHURST read a paper entitled End-Results of Fractures of the Femur Treated Conservatively, for which see page 748.

DR. RICHARD H HARTE said he could not understand why so many surgeons, instead of sticking to old and tried methods of procedure always wanted to try something else just because it was new. He really thinks it remarkable that in fractures of the thigh the results are so good, for he thinks this bone, above all others, is badly treated. Everyone seems to think that in order to treat a fracture of the thigh all that is necessary is to hang on to the heel 6 or 8 pounds of weights, paying no attention to the extension of the leg or the relative position of the sand-bags to the leg.

He thinks Dr. John Ashhurst is the surgeon to whom the greatest thanks are due for the conservative treatment of fractures of the thigh. To obviate the use of sand-bags he reverted to the use of the old-fashioned Dupuytren's splint in conjunction with bran-bags and weights.

Dr. Harte does not recall a single case of ununited fracture of the thigh in his experience. In cases where there are multiple fractures, great allowance should be made, as Nature is only capable of repairing a certain number of fractures at a time. Very often the larger bone is the one which will be the slowest to unite.

DR. G. G. DAVIS said he thought the results in these cases rather surprising. When it comes to fractures below the neck we rather expect unfavorable results, but here in 21 cases of the neck we find 5 cases with apparently perfect functional results, 8 with no disability but a limp, 6 with marked impairment of function, and only 2 incapacitated. It is not infrequent for patients with intracapsular fractures to take to their beds and remain there until they die. Dr. Davis thought if the impairment of function in the 6 cases mentioned even allowed the patients to get around at all, that the results were surprisingly good, particularly when it is remembered that in these cases there were various forms of treatment. He understood that some of the methods pursued were not the so-called modern methods of abduction or lateral traction, but were simply the employment of the ordinary Buck's extension.

DR. A. P. C. ASHHURST, in closing, said that of the 5 patients with fracture of the neck of the femur who recovered without functional impairment, two were children, one was a man 70 years of age. When this latter patient came back to the hospital

with no impairment whatever, it was necessary to look up his history, which showed that the diagnosis had been confirmed by a skiagraph, to convince the examiners that he had really sustained a fracture of the neck of the femur Dr Ashhurst added that Dr Newell and he agreed entirely with Dr Harte that the question of shortening was of secondary importance, since, as Dr Harte said, it was of course impossible to know what had been the length of the fractured limb before the accident He thought, however, if a patient had been so unfortunate as to have one leg an inch or more longer than its fellow, he would have to be congratulated should the result of his fracture enable him to be discharged with two legs of equal length

GERGUNY'S OPERATION FOR THE CURE OF ENURESIS

DR GWILYM G DAVIS presented a young girl, aged 15 years, who was admitted to hospital under his care with the following history She had had most all of the diseases of childhood besides typhoid fever Menstruation began at the age of 12, and she stated that she did not menstruate from the vagina but at each monthly period had considerable bleeding from the nose accompanied by headache A year and a half previously she passed through an attack of typhoid fever at another hospital She has always been of a nervous disposition and a year ago began to have nocturnal incontinence of urine She passed urine involuntarily five to seven times each night She was under treatment for the trouble in the medical ward and was afterwards operated on for appendicitis three months previous to her present operation

Urine Sp gr, 1020, acid, no albumin nor sugar, few epithelial cells, no urethral polypus or other abnormal conditions

She was etherized and the urethra surrounded by a circular incision and loosened from its surroundings It was then twisted three-fourths of a turn on its longitudinal axis until a feeling of resistance was experienced, the margin was then sewn to the adjacent tissues by interrupted sutures of fine chromic gut A catheter was inserted and retained for two or three days Primary union occurred and she was soon discharged from the hospital cured

The procedure used in this case was that devised by Gerguny (*Centralblatt für Chirurgie*, 1888) and is similar to his well-known operation for incontinence of feces (*Centralblatt für*

Chirurgie, 1893, 261) While his operation on the rectum is widely and favorably known, his operation on the urethra is comparatively little known and rarely employed Incontinence of urine is so much more common than incontinence of feces that the field for the operation in the former class is much the wider It is an operation comparatively easy of performance, lacking in any serious danger or after-effects and apparently efficient It only needs to be more widely known in order to be more extensively employed

A METHOD OF ANASTOMOSING THE DIVIDED VAS DEFERENS

DR GWILYM G DAVIS said that a couple of years ago while aiding an inexperienced assistant to do an operation for the radical cure of an inguinal hernia the vas deferens was torn It was strongly adherent to the hernial sac and in attempting to detach it he tore it in two

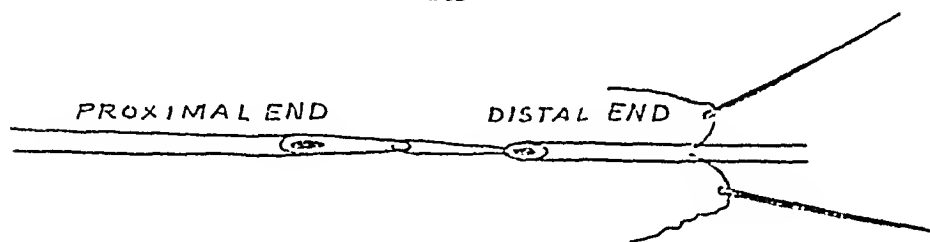
At the time the only methods known to Dr Davis of repairing the injury were those which had been used for anastomosis of the ureter The only method, as far as he knows, which has been devised for the anastomosis of the vas deferens is that of G. Frank Lydston (*Annals of Surgery*, July, 1906, p 92, vol xlv) who cut the ends off square, then introduced a filament of silkworm gut on a filiform bougie through an opening in the side and sewed the two square cut ends together The sheath of the cord was then sewn around the point of union and the bougie withdrawn in ten days

The method adopted in the present case was a modification of that devised by Poggi for the ureter Poggi (*Archives Provinciales de Chirurgie*, vol vi, June 1, 1896, quoted by Morris *Surg. of Kidney and Ureter*) dilated the distal end of the ureter and drew the proximal end into it by two sutures, one on each side Both ends of the ureter were cut off square

Mayo Robson modified this by slitting the distal end to facilitate the entrance of the proximal end Van Hook introduced the proximal end through a slit in the distal end on which a ligature had been placed to close its extremity In the case now reported the proximal end of the divided vas was cut off obliquely so as to leave a moderately long pointed extremity, the distal end was cut off on a short bevel, about 45°

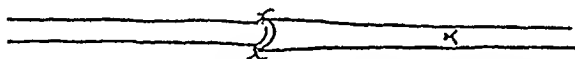
A piece of fine catgut was then threaded on two fine round sewing needles. One of these needles was passed through the tip of the proximal end then introduced into the lumen of the distal end and made to pierce the wall well beyond the opening. The second needle was then likewise introduced and brought out close to the first (Fig 1)

FIG 1



Traction was made on the threads and the pointed extremity of the proximal end entered the lumen of the distal end without the slightest trouble until its apex reached the point of emergence of the needles. The catgut was then tied and the apex fixed in place. Two additional fine catgut sutures were introduced, fixing the extremity of the distal end to the side of the proximal end as seen in the lower figure (Fig 2). Healing occurred by primary

FIG 2



union, no epididymitis nor testicular complication occurred, and as far as known the result was satisfactory.

In making the anastomosis care should be taken not to make the pointed bevel on the proximal end too long and also to introduce the needles nearly or quite their full length before piercing the side of the tube. The object of these two precautions is to separate as far as possible the two openings in the proximal and distal ends.

It appears to be unnecessary to slit the ends as did Mayo Robson and Van Hook in the ureter, and the procedure seems both easier of performance and more sure than that of Lydston.

DR JOHN H GIBBON, relative to the anastomosing of the divided vas deferens, asked if Dr Davis knew anything of the end-result in his case, whether there was testicular atrophy

Dr Gibbon once, very much to his distress, divided the vas in a young man, and did an invagination anastomosis, very much after the style of Murphy's anastomosis of a blood vessel. Although he was very much disappointed at the time of this accident, he got a great deal of comfort in finding out that a number of men who had done a large number of hernia operations had had a similar experience. He feels certain, however, that such an accident having once occurred, it is never likely to be done by the same operator again. In reply to this question Dr Davis stated that the later history of the patient was not known to him.

THE USE OF CHLORIDE OF ETHYL AS A GENERAL ANÆSTHETIC

DR W E LEE read a paper with the above title, giving a report of 5000 cases at the Pennsylvania Hospital. For this paper see page 641.

DR G G DAVIS asked how many of the patients which died were colored people? He thinks anæsthetics are far more fatal with this race than with white people because their color prevents the early recognition of the changes due to failure in the circulation.

DR JOHN H GIBBON said Dr. Lee had shown how superlatively statistics can lie, and he thinks that everyone reaches his own conclusions as to the safety of anæsthetics from his personal experience. For five or six years Dr Gibbon has used chloride of ethyl absolutely for short operations, nothing but chloride of ethyl, and practically always uses it as a preliminary to ether. He has in his experience but one death to report. That was in a man who had a Ludwig's angina and an endocarditis. He was afraid to give him any general anæsthetic because of his heart condition, and therefore infiltrated the line of incision with Schleich fluid first, and then he found that the patient had a lot of exudate deep down in his neck and manipulation was very painful, so it was necessary to give him an anæsthetic. Chloride of ethyl was given, followed by ether, and Dr Gibbon then evacuated a quantity of turbid fluid from behind the sternum. Just as this fluid was evacuated the patient ceased breathing and died on the table. No ether had been given for a number of minutes, as the patient seemed completely anæsthetized. A quick

tracheotomy was done and artificial respiration kept up for some time, but without avail

As Dr Lee has said, deaths in these cases occur from any anæsthetic. Excepting the case just recorded Dr Gibbon has never had a death from chloride of ethyl, and he has used it thousands of times with the greatest impunity. His feeling is that in safety it occupies a place between ether and chloroform. Most people think it more fatal than ether, and probably less than chloroform. Dr Gibbon gives it to the youngest and to the oldest patients—children a few days old, very ill patients with typhoid perforation, and patients with tuberculous lesions of the lungs. It is the anæsthetic of choice in his worst cases.

In one, a tuberculous case, he resected four ribs for empyema, and he has done other extensive operations lasting as long as twenty minutes. In the cases where death has occurred, he thinks it would have occurred with any anæsthetic. He has had more than one death occur on the table from ether alone, and in one of these cases there was no pulmonary or cardiac lesion. The patient was suffering from tuberculous glands of the neck and died just as the incision was made.

Dr Gibbon's experience with chloride of ethyl makes him feel that it is a safer anæsthetic than ether. It is not disagreeable to take, and he says this because he has himself taken it. He does think it should be given with discretion. It has the great advantage of shortening the time for the anæsthetic and cutting down the amount of ether which the patient will have to inhale and afterwards eliminate.

In comparing the mortality in anæsthesias we should also include the cases of postoperative pneumonia, bronchitis and suppression of urine occurring as a result of ether.

DR A. P. C. ASHHURST reminded the Fellows that his father, the late Dr John Ashhurst, Jr., used to lay a great deal of stress on giving ether in a good light, and constantly inveighed against the miserable dark holes provided for the administration of anæsthetics in one large hospital to which he was surgeon.

DR RICHARD H. HARTE had used ethyl chloride a great deal and for many years, but is not as enthusiastic over its use as some operators are. Every time he gives it it is with a feeling of uncertainty, because one cannot carelessly give an anæsthetic which is so quick in its action. He has many times started to count twenty

with the beginning of this anæsthetic and by the time twenty would be reached the patient would be completely anæsthetized. The great danger of this anæsthetic is therefore the little warning which is given. It is, however, one of the most delightful anæsthetics which can be imagined—no nausea, no choking sensation, no distress of any kind, the patient simply passing into a quiet sleep.

Dr Harte feels, however, that if it was used as indiscriminately and as carelessly as is ether, the mortality from its use would be much greater. He considers it a great wonder, with the careless way in which ether is administered, that its mortality is not greater. Ethyl chloride is given by few surgeons, and only practically by persons skilled in its use or in the use of anæsthetics, and consequently the mortality rate is low. It has a great many advantages, particularly preliminary to the administration of ether, and it has also undoubtedly cut down the quantity of ether necessary to complete unconsciousness.

Dr Harte never gives ethyl chloride except as a preliminary in any case where he expects a delay. He uses it for opening an abscess or for putting in a drainage-tube, but where the patient is to be kept under the anæsthetic for any length of time, say more than five or six minutes, he does not use ethyl chloride.

Relative to the remark made by Dr Gibbon that he had never experimented with anæsthetics on himself, Dr Harte thought more could be learned from such experimentation than from the anæsthetization of five hundred other people.

DR W. JOSEPH HEARN agreed with Dr Harte that the rapidity with which anæsthesia is induced with chloride of ethyl is its chief danger. A few years ago at the Jefferson Hospital when the bottle of ether was immersed in a tub of hot water during administration it was found that the concentration of the vapor was too great, and this method of administration consequently had to be abandoned because the anæsthesia was induced so rapidly that it was hard to recognize the danger signals.

DR WALTER E LEE, in closing, said that in regard to the color of the patients who died, all five of them were negroes and that one of the ether deaths occurred in a patient of this same race. The question of the rapidity of the appearance of anæsthesia, of which Dr Harte and Dr Hearn have spoken, is undoubtedly an objection to the general use of ethyl chloride. As

it is given in England in large mass doses of from 3 to 10 cc in a closed inhaler with the admission of very little air, deep anæsthesia is reached after 5 or 10 inspirations. In Dr Lee's experience the danger signs during the administration of ethyl chloride are very difficult to recognize, the slowing of the respiration is insidious and they have probably ceased for some seconds before the anæsthetist realizes it. For this reason the closed inhalers have been abandoned in the hospital and the open method used which has lengthened the administration period from 8 to 10 seconds to 3 to 4 minutes, giving more time for the recognition of the danger signals

BOOK REVIEWS.

THE PANCREAS ITS SURGERY AND PATHOLOGY By A. W MAYO ROBSON, D Sc (Leeds), F R C S (Eng), of London, and P C CAMMIDGE, M D (Eng) D P H (Cambr.), of London. Octavo vol, pp 546 Illustrated W B Saunders Co Philadelphia and London 1907.

THE present monograph by the authors succeeds in some degree that published by Robson and Moynihan a few years previous. The association of an expert chemist with a surgeon who has had such an extensive experience in the diseases of this organ, has certainly given to the literature a contribution which at the present time ranks preeminently.

The scope of the work, however, is considerably more comprehensive than its title would indicate. Thus in the first seven chapters we find an exhaustive and excellently compiled treatise on the comparative anatomy, anatomy, embryology, anatomical anomalies, surgical anatomy, histology and physiology of the pancreas. The authors here, as in the remainder of the monograph, have used all of the more important contemporary literature in conjunction with their own researches, a short bibliography being appended at the end of each chapter indicating the references used in the subject under discussion. Then follow two chapters on pathology and fat necrosis, leading directly up to that on chemical pathology, here is described the "Cambridge Reaction", the methods employed certainly seem in some degree rather empirical, and were it not for the results obtained would be rather disquieting, the analysis is exacting and must be followed carefully or results will not be obtained; especial attention should be directed to the last step of using a hot filter paper and funnel.

The question of diabetes is of great interest. The author's conclusions are in effect that a small portion of normal gland is capable of averting the onset of the condition, and therefore the importance of recognizing diseases of the pancreas early is emphasized. Advocation of early operation in gall stones especially in the common duct when urinary analysis shows pancreatic

involvement to be present, is deservedly mentioned. The consideration of the fæces as indicative of digestive disturbance, as well as that of the urine for changes in the internal metabolism, is of great diagnostic value.

An interesting observation is that the presence of biliary secretion is not sufficient to insure a return of the normal color to the fæces when pancreatic secretion is not established.

The surgical progress in the treatment of pancreatic conditions is shown with the report of several cases. The authors illustrate uselessly some X-ray photographs showing the difference between gall stones and pancreatic calculi. These, however, have been taken outside of the body and the conclusions drawn from them are entirely at variance with those found when the exposure is made *intra vitam*.

The book is completed by the chapters on injuries, inflammatory affections, acute, sub-acute and chronic pancreatitis, pancreo-lithic catarrh, calculi, cysts, and neoplasms. That on the general symptomatology and diagnosis is of particular fulness and interest, and is sure, when taken into consideration with the various chemical and microscopical adjuncts placed at our disposal, to alter the views of many physicians and surgeons at present that only the grosser lesions of pancreatic affections may be recognized.

JAMES T. PILCHER

TO CONTRIBUTORS AND SUBSCRIBERS.

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 386 Grand Ave., Brooklyn, N. Y.

Remittance for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS OF SURGERY,
227-231 South Sixth Street,
Philadelphia

ANNALS OF SURGERY

VOL XLVIII

DECEMBER, 1908

No 6

ORIGINAL MEMOIRS.

INVAGINATION OF MECKEL'S DIVERTICULUM.

REPORT OF A CASE AND A STUDY OF THE LITERATURE

BY H. TYRRELL GRAY, M.C. (Cantab.), F.R.C.S. (Eng),
OF LONDON,

Resident Medical Superintendent Great Ormond Street Hospital for Sick Children

A PERSISTENT Meckel's diverticulum in the human body is at all times a serious menace to life. It has been roughly estimated that this anomaly is present in 2 per cent of bodies (this figure is probably too low), and it is likely that few persistent diverticula exist without giving rise to some marked symptoms.

The mortality from intestinal obstruction and peritonitis due to this abnormality is so high that it would not only be justifiable, but necessary, to remove this structure by operation could a diagnosis of its existence be arrived at before serious symptoms necessitate an urgent operation under usually unfavorable conditions.

The foregoing opinion has led me, during the past few years, to make a special study of this variety of intestinal obstruction, and, since the subject is too large to be dealt with in a single paper, I propose to consider "*Invagination of Meckel's Diverticulum*" and its complications. A case of this nature has recently come under my observation, and presents many points of interest. The child was under the care of Mr. Arbuthnot Lane, to whom I am indebted for his courtesy in permitting me to publish the case.

The details are as follows Alfred B, male, act 8 years Admitted into the Hospital for Sick Children, Great Ormond Street, February 5, 1908

Past History—The mother states that as a baby he passed blood in the motions once, after a dose of salts At 5 years, he had a definite attack of violent abdominal pain accompanied by vomiting and the passage of blood "per rectum" This attack lasted one day, after which the symptoms passed off The mother had further noticed that frequently, on going to stool, the child "stamped and went white as if in pain," but made no complaint

History of Present Illness—The onset of the present attack, on Thursday, January 30, was characterized by severe pain in the "lower half of the stomach" (the child pointed across the umbilicus when questioned) The pain continued on the 30th and 31st of January, though the child attended school

On February 1, the bowels acted as a result of some licorice powder, the pain diminished, and he felt better Patient felt better till the afternoon of February 2, when, while at Sunday school, he was attacked with violent abdominal pain The bowels acted February 3, pain was more acute, retching supervened and from this time onwards there was absolute constipation February 4, child quieter, but refused food, vomited three times February 5, vomited three times The mother thinks there was some blood in the vomit *No blood was at any time passed per rectum*

State on Admission—Temperature, 101° F, pulse, 100 Patient looked ill Facies of the abdominal type

Abdomen—Considerable distention, especially above the umbilicus The contour of the abdomen conformed to the type of a small intestine obstruction and distended coils of gut were clearly outlined Movement was free everywhere, while there was no tenderness or rigidity No tumor was felt

When in bed the child slept for about an hour and seemed comfortable Examination of the rectum, which was filled with scybala, was negative The *umbilicus* was raised and dome shaped, and the skin was of a bluish tint and scarred to a marked degree, the abnormality was sufficient to attract attention at once A high enema yielded no result The tongue was brown but moist in fact the general condition, in spite of a history of seven days, was comparatively good The bladder was distended and a con-

siderable quantity of urine was drawn off by a catheter before operation

In view of the fairly characteristic past and present history and the condition of the umbilicus, intestinal obstruction, due to a persistent Meckel's diverticulum was suspected, the real nature of the case was made clearer by the palpation of a sausage-shaped tumor lying beneath the liver, before opening the abdomen, when the patient was under the influence of chloroform

Operation —The abdomen was opened by a 4-inch incision by splitting the fibres of the right rectus. A good deal of straw-colored fluid escaped on opening the peritoneum, and the intussusception was immediately found with two fingers in the abdomen. Reduction was effected by manipulation till the cæcum was free of contents, when it was found that an irreducible enteric intussusception remained, which had caused the ileocæcal one, now reduced. The irreducible mass was about 4 inches long and extended to 3 inches above the ileocæcal valve, while through the intestinal wall, below the presenting part, could be seen and felt a polypoid mass projecting into the lumen of the termination of the ileum.

The intussusception, with two inches of healthy gut above and below was excised, thus leaving 1 inch of healthy ileum adjoining the cæcum. During the operation saline infusion had been administered, and, since the child's condition was fairly good, an immediate axial anastomosis was decided on. This procedure was accomplished in the usual way, and the abdomen sewn up in layers, the operation lasting a little over $1\frac{1}{4}$ hours. The patient stood the operation well and gave no cause for immediate anxiety till about 6 hours later, when froth tinged with fæces persisted in coming from the nostrils, a condition which continued until death 15 hours after operation (a motion containing blood and mucus had been passed shortly after the child was returned to bed).

At the autopsy, the anastomosis proved in every way satisfactory and there was no sign of infection of the peritoneum.

Examination of the Specimen (see Fig 1) —On opening up the specimen it was seen that the intussusception had been started by an invaginated Meckel's diverticulum about $2\frac{1}{2}$ inches in length. All the coats were completely invaginated and, with the intestinal wall involved, quite gangrenous. Just below the origin

Number	Author	Sex	Age	Previous abdominal crises	Duration of final attack	Remission in major attack	Onset during rest or active movement	Passage of blood per rectum	Passage of feces or flatus
1	Gray	M	8 years	2 Definite, probably more	7 days	One	Active movement	None	Two stools
2	Watson Cheyne	M	19 years	Many	7 days	Two	Rest	None	One stool
3	Von Mandach	M	2½ years	None	7 days	None	Active movement	None	Diarrhea
4	Bidwell	M	3½ years	Many	8 days	Oper		None	None
5	Robinson	M	5 years	Many in definite	2 days	One	None (enema tinged) Melena	None	One stool
6	Weill & Frankel	F	4½ years	None	1 day	None		None	None
7	Holbeck, ²⁹	M	18 years	None	3 days	None		None	None
8	De Quervain	M	16 years		2 days	None		None	Many stools
9	Von Strubenrauch, ³⁰	F	5½ years		5 days			Yes	Many stools
10	Brunner	M	4 years	None	3 days	None		Yes	None
11	Terry	M	12 years		½ a day	None	Activity	Yes	One stool
12	Travers, ³¹	M	10 years		1 day	None		None	None
13	Morrison ³²	M	5 years		1 day	None		Yes	
14	Wainwright	M	17 years	None	1½ days	Gradual onset	Activity	None (enema tinged)	None
15	Adams	M	42 years	One	More than 7 days			None	
16	Zum Busch	M	21 years	Many	2½ days	None	Activity	Yes	? several motions
17	Coffey	M	7 years	Numerous	4 days	One		None	Two motions flatus also
18	O'Connor	M	13 years			None		None	None
19	Pitts, ³³	F	8 years		5 days			None	4 motions
20	Eve ³⁴	M	13 years		28 days				

Situation of pain	Tenderness	Metecism	Abnormality of umbilical cicatrix	Palpable tumor	General condition compared with duration of final attack	Operation	Result	Appearance of Diverticulum, etc
Umbilical region	None	Gen'l	Marked	Only under anæsthetic	Good	Yes (Res)	Death	Gangrenous, slightly club shaped, all coats of Diverticulum invaginated
Epigastrium	1½" below umbilicus	Varying		Yes	Good	Yes (Res)	Recovery	Small degree of stenosis of gut
		Gen'l			Good	Yes (M Red) Yes (Res)	Recovery Recovery	Much inflammatory thickening
Umbilicus	None	Gen'l	Umb hernia	Yes	Bad	Yes (M Res)	Death	Only mucosa invaginated
						Yes (Res)	Death	Inflammatory stenosis of gut
	None	Gen'l		Only under anæsthetic		Yes (M Res)	Death	
		Gen'l		None		Yes (Res)	Death	Diverticulum gangrenous all coats invaginated
		Gen'l		Yes		Yes (Res)	Death	
		Gen'l		Yes	Bad	Yes (Res)	Recovery	Accessory pancreas on apex of Diverticulum (? a real Meckel's diverticulum)
Just below and to the right of umbilicus					Good	Yes (M Res)	Recovery	
Right side of abdomen				Yes		Yes (M Red)	Recovery	
				Yes		Yes (M Res)	Recovery	
Lower zone of abdomen	Situated with the pain	None		None	Good	Yes (M Res)	Recovery	
				None	Good	None	Death	Evidence of previous inflammation of Diverticulum
Umbilicus				Yes	? Fair	Yes (Res)	Recovery	Subserous lipoma at apex of Diverticulum
				Yes	Good	Yes (Res)	Recovery	Intussusception and Diverticulum gangrenous
				None	Good	None	Recovery	Intussusception sloughed out per rectum
				Yes	Good	Yes (Res)	Recovery	Gangrenous
						Yes (Res)	Death	

Number.	Author	Sex	Age	Previous abdominal crises	Duration of final attack.	Remissions in major attack	Onset during rest or active movement	Passage of blood per rectum	Passage of faeces or flatus
21	Erdmann, ³⁵	F	9 years	One marked	2½ days	None	Activity	Yes	None
22	Ingle, ³⁶		12 years		5 days	None		Yes	None
23	Cawardine		12½ years		2 days				
24	Kuttner	F	49 years		3 days	None		None	None
25	Maroni	M	26 years	Many marked					
26	Ewald								None
27	Strauch	F	6 years		2 days	None	Rest	None	Numerous motions
28	Bayer, ³⁷	M	2½ years	Many	Chronic	Many	Activity No definite onset	None	Many motions
29	Rehn	M	30½ years						
30	Jäckh	F	30 years	Many	Chronic	Many	No definite onset	None	Many motions
31	Forgue & Riche	M	60 years			Partial obstr			
32	Guyot ⁴⁰	M	6 years		5 days				

No	Author	Further cases of which no clinical details are given
33	Heller	Worm-like Diverticulum with lumen obliterated in lumen of intestine Found at autopsy
34	Heller	Movable cord in lumen of intestine with accessory pancreas at apex Found at autopsy
35	Heller	Specimen
36	Treves	Specimen in Guy's Hospital Museum
37	Treves	Specimen in Royal College of Surgeons
38	Adams, ³⁸	Specimen from a case ending fatally after 14 days acute illness
39	Studsgaard, ³⁹	M aet 37 years Resection Death Intussusception caused by invagination of Meckel's Diverticulum
40	Boldt	Child Invagination of Diverticulum (? Meckel's) started an intussusception

Situation of pain	Tenderness	Meteorism	Abnormality of umbilical cicatrix	Palpable tumor	General condition compared with duration of final attack	Operation	Result	Appearance of Diverticulum, etc
Right side of abdomen	Situation not stated	Gen'l		None	Bad	Yes (Res)	Death	Club-shaped Evidence of previous inflammation Invagination of Diverticulum only 3 perforations
		Gen'l			Bad	None	Death	
		Marked and gen'l			Fair	Yes (M Red)	Death	
						Yes (anastomosis only)	Death	
Burning pain at umbilicus	Present situation not stated	Gen'l	.	Yes	Good	Yes (obstruction not removed)	Death	Diverticulum only invaginated Polypus the size of a cherry attached to base of Diverticulum Invaginated Diverticulum only Also stenosis of gut at its attachment due to inflammation
		None				Death		
		Gen'l			Yes	Yes (Res)	Death	
						Yes (M Red)	Recovery	
General		Gen'l		Yes	Good	Yes (Res)	Recovery	Club shaped Intussusception started above Diverticulum which was probably invaginated independently
						None	Death	
						Yes (anastomosis only)	Death	

N B —Res = resection of intestine

M Res = resection of Meckel's diverticulum

M Red = invagination of Meckel's diverticulum reduced

of the diverticulum from the opposite mesenteric border, the intestine was considerably stenosed (Fig 1) The total amount of intestine resected was about 18 inches

This case is a most instructive one and full of interest, while the points to which I particularly wish to draw attention are drawn up in an appended table (See Table) I have been able to collect 39 cases of Invagination of Meckel's Diverticulum which, with my own case, make up a total of 40

The condition is not common, though, I believe, not as rare as is generally supposed An invagination of Meckel's diverticulum has usually produced an intussusception of the intestine also, out of the 40 cases I have collected, in 7 only was the diverticulum alone invaginated, while one of these was involved in an intussusception arising above the attachment of the diverticulum to the gut, and was therefore probably of independent origin (Rehn¹)

Forgue and Riche² give these figures as 6 out of 33, while now with the additional cases I have collected, the figures are 6 out of 40 That is to say, invagination of Meckel's diverticulum alone occurs in 15 per cent of cases and causes intussusception of the intestine in 82 per cent

The reason, in the first place, for the rarity of this lesion is that, for such an occurrence, the diverticulum must be free, and this is the most uncommon condition met with³ Usually this structure acquires a secondary attachment to the mesentery or more rarely the intestine, and less commonly still remains fixed to the umbilicus³ In the second place, once invaginated into the lumen of the intestine, Meckel's diverticulum acts like a polypus in tending to produce an intussusception

Sex—This appears to be a matter of some importance, for, out of the 30 cases in which the sex is mentioned, 23 were males and 7 females, giving a figure of 76 per cent males Now this marked preponderance of males over females does not agree with anatomical findings, and one can only conclude that this structure, when present, is more likely to give rise

to symptoms in males than females. This, as a fact, is the case, and the reason will be shown later.

Age—This is a matter of some weight in diagnosis, for the average age at which the final attack has occurred is 15 years. Out of 32 cases where the age is stated, 16 (50 per cent) were under 10 years, 9 between 10 and 20 years and 8 over 20 years, while it is important to note that only 2 cases occurred under 2 years, the *commonest age* for the occurrence of intussusceptions, this will be again referred to later.

The commonest period of life, then, for this lesion is childhood and early adult life.

History of Previous Abdominal Crises—I cannot lay stress too insistently on the importance of obtaining a most accurate history of past ailments, however trivial, in any case of acute abdominal disease—out of the 17 cases where the past history is detailed, in 12 (70 per cent) was a definite account of previous abdominal crises obtained. Recurrent abdominal crises are common, and constitute a most important symptom, in persons harboring a persistent Meckel's diverticulum,⁴ and, in many of the cases appended, the history alone, in my opinion, was sufficiently definite to warrant an exploration before the onset of acute symptoms.

To quote briefly from some of these histories. In my own case, the patient passed blood, even as an infant, had a violent attack of abdominal pain accompanied by vomiting and the passage of blood at 5 years, and appeared to suffer frequently on going to stool. In Watson Cheyne's case⁵ the man complained of abdominal discomfort for two years leading up to an attack of diarrhoea and vomiting 8 months before coming under observation. These crises with flatulence and vomiting increased from fortnightly to weekly intervals, gaining always in intensity.

Bidwell's case⁶ had a severe hemorrhage from the rectum 6 months previously, and upon this supervened weekly attacks of abdominal pain and vomiting *on rising in the morning*, which passed off after an hour or so.

Robinson's case⁷ complained of occasional abdominal

pain, and that reported by Zum Bush⁸ gave a similar though more definite account of recurring crises

In this connection Coffey's case⁹ is well worthy of note, for this child 5 years previously was attacked with severe abdominal cramps with cold sweats and vomiting, which lasted 36 hours, and was followed by similar attacks every month accompanied by the passage of blood per rectum on each occasion

Kuttner's¹⁰ and Adams's¹⁷ patients had previously suffered from an attack of acute intestinal obstruction, which had subsided spontaneously, while Ewald¹¹ reports a similar attack followed by recurring crises leading to a diagnosis of intestinal stenosis. Strauch,¹² Rehn¹ and Jakch¹³ all report perfectly definite attacks of violent abdominal colic or cramps, varying in their intensity, their persistency, and in their concomitant symptoms

The above cases well repay perusal, and I can only repeat that such accounts, especially in the presence of other signs, should warrant a strong suspicion of the presence of a Meckel's diverticulum

As regards the explanation of these crises, I have elsewhere³ remarked on the liability to twisting and consequently slight attacks of inflammation to which such a structure is liable, especially in view of its poor blood-supply while the laxity of its mucous membrane,⁵ in a free diverticulum, added to such attacks of inflammation, renders it prone (as I hope to show later) to recurring partial invagination which would well account for the frequent passage of blood in many of the recorded cases

The Onset, Character, and Duration of the Final Attack
—When a case is finally under observation for the treatment of acute symptoms, it is often of considerable importance to arrive at an accurate diagnosis, especially as the general condition in many of these patients we are considering is, in my experience, particularly apt to be misleading as regards the severity of the lesion. If column 15 in the table be referred to, it will be seen that I have attempted to arrive at a reasonably

accurate conclusion from the data as to the condition of the patient when compared with the duration of the attack. It seemed to me, on reading the reports, that the condition was good or fair in 14 and bad in 4 out of the 18 cases where I was able to form an opinion. Some stress is laid on this, because in my own case I was nearly misled by the comparatively excellent condition of the boy (he was seen on the seventh day of the attack) who slept comfortably for over an hour on admission, and did not complain of pain, while there was no evidence of peritonitis.

The explanation is that the early symptoms are due to the invagination, or inflammatory attacks preceding the invagination, of the diverticulum itself, while the succeeding intussusception or gangrene of the intestine often does not occur till a day or two later. The duration is in consequence longer and the patient's condition better than might be expected, while the illness tends to start somewhat gradually and increase in intensity to the climax, when the more serious lesions supervene. This is a point of importance in the diagnosis from volvulus, for which the condition has been mistaken (Kuttner¹⁰).

It would be expected from the above remarks that remissions, or temporary relief, would be observed during the final attack, this in fact has been remarked in several cases. These remissions are well illustrated in the history of the case here reported, as also in Watson Cheyne's case⁵. Coffey's case⁹ is no exception, while Rehn's¹ and Jakch's¹³ cases show how this feature can be so marked that the onset is subacute or chronic in nature. In the former case there were never any acute symptoms, the operation being performed at the most favorable period, *i e*, before the onset of any acute symptoms.

Another important point in this connection is the time of onset. In every case where the point is mentioned, except that of Strauch,¹² the acute symptoms started during activity. As a contrast, acute appendicitis, which is closely simulated by this condition, commonly starts while the patient is at rest, and usually in the early morning. Thus my case was at school

at the time, while in Bidwell's ⁶ the attacks occurred "on rising in the morning" Terry's case ¹⁴ was at school, Wainwright's, ¹⁵ out for a walk to get rid, apparently, of the discomfort and fulness, etc., from which he had been suffering from some days previously Zum Busch's ⁸ patient was an acrobat, and the history of this case is particularly interesting Kelly ¹⁶ gives a list of the factors tending to produce torsion of Meckel's diverticulum which, I believe, precedes invagination—amongst these are the perpetual movement of the intestines, and the continual play of the abdominal muscles This accounts for the frequency with which the minor crises, as well as the final acute illness, take place, when the abdominal muscles are being used, and it also explains to some degree the large preponderance of males over females, whose lives are so much more sedentary In this connection it is also interesting to note that infants are almost exempt, for only two cases occurred under 2 years, while children under 10 years show the highest percentage, and this age is that of the greatest activity

Thus in my case, the child appeared to suffer pain on going to stool, while in Brunner's ²¹ the onset took place immediately after opening the bowels, this last feature I have noticed in acute lesions of Meckel's diverticulum other than invagination As regards the duration of the final attack, if the chronic cases be excluded, the average figure was $3\frac{1}{2}$ days, though 12 cases showed a history of over 5 days duration

Finally in connection with the onset, the character of the pain is always severe, usually violent, and frequently situated in the umbilical region It has been variously described as colicky, cramp-like, and on one occasion it was preceded by burning pain at the umbilicus (Rehn ¹) Vomiting is a constant symptom

Passage of Blood per Rectum, etc—In spite of the frequency with which invagination of Meckel's diverticulum leads to intussusception, it is a curious and noteworthy point that a large number of cases pass no blood during the final attack

Thus out of 25 cases, in which this sign is referred to, only 7 passed bright blood (28 per cent), one suffered from abundant melaena (Weill and Frankel¹⁸) and 17 passed no blood at all (68 per cent). In two of these 17 cases the enema was tinged with blood only (Robinson⁷ and Wainwright¹⁶). This is a noteworthy diagnostic feature, for the palpation of the characteristic tumor together with this negative sign would seem to warrant a suspicion of the real nature of the lesion. If the table be referred to, it will be noticed that those cases in which blood was passed were mostly those with a short history, it seems probable, therefore, that the invaginated diverticulum becomes gangrenous early (it will be remembered that the blood supply is nearly always derived from that of the adjacent intestine, and is of the poorest) and a certain amount of paralysis of the intestine ensues which prevents the blood from being passed. In support of this, my own case passed blood with a motion after the operation. Another striking feature is that constipation is seldom absolute (11 cases out of 24), 13 cases, or over 54 per cent, passed at least one motion, several passed more than one, while diarrhoea was a feature in Von Mandach's case¹⁰. This characteristic is in keeping with the nature of the onset and may prove of considerable aid in establishing a diagnosis.

Tenderness as a rule is not present in any degree, unless peritonitis has set in, when it is diffused.

Meteorism is general, when present, and the shape of the abdomen conforms as a rule to the type usually seen in a small intestine obstruction, distended coils of gut are frequently visible. There is, in this class of case, no localized meteorism so characteristic of strangulation by a diverticulum.⁷

A Palpable Tumor is mentioned 16 times, its detection occurring twice under anæsthetic only, probably distention, which is commonly present, prevented a satisfactory examination in the remaining cases, or the diverticulum only was invaginated.

Abnormality of Umbilical Cicatrix—I have elsewhere⁷ drawn attention to the value of this sign in the diagnosis of

the presence of a Meckel's diverticulum, and for details I would refer the reader to that paper. I will only emphasize here that, when present, it has proved of great value in the recognition of the cases which have come under my personal observation, and, in the present report, was of considerable assistance in the formation of a correct diagnosis. I regret that unfortunately no photograph was taken of this child's umbilicus.

As to the frequency with which this sign is present, it is impossible to make a statement, since no mention is made of it by any author except Bidwell,⁶ who only remarks on a previous umbilical hernia, for the cure of which he had operated.

Pathology —Several views have been advanced to account for the invagination of the Meckel's diverticulum, which must of necessity be lying free in the abdominal cavity. Such free diverticula are particularly liable to undergo torsion about their own longitudinal axis. Any one of these accidents may prove fatal, by causing gangrene of this structure, many such cases have been reported,³ though it is foreign to my purpose to discuss them now. Repeated slight torsions would have the effect of causing some degree of obstruction at the attached end, with consequent œdema and swelling of the free end, and also with the outpouring of mucus into the lumen of the diverticulum. Evidence of this is seen in examining specimens in which the diverticulum is usually club-shaped, its bulk narrowing to a neck at the point where it is attached to the intestinal wall. Evidence of inflammatory thickening at this spot, even extending to, and causing stenosis of, the neighboring intestine, is mentioned by several authors in their reports. Thus Watson Cheyne,⁵ Adams,¹⁷ Kuttner,¹⁰ Ewald,¹¹ Strauch,¹² Jakch,¹³ and Heller,²⁰ all describe such pathological evidence, while to this may be added my own case.

The following explanations of the process of invagination have been given.

Kuttner¹⁰ says that invagination is set up by the pres-

ence of an accessory pancreas, a polypus, or a fecal mass in the diverticulum

An accessory pancreas situated at the tip of this structure is mentioned by Brunner²¹ and Heller,²⁰ while in Zum Busch's case⁸ there was a subserous lipoma in the same situation. Such tumors would, in my opinion, tend to prevent, rather than to assist, invagination, and even if they did explain the process in these cases, to the majority, in which no such tumors are found, some other mechanism must be assigned.

A polypus when present would undoubtedly account for invagination. In Maroni's²² case a polypus the size of a cherry was probably responsible, but this tumor, it should be noted, was attached to the base, and *not* the apex of the diverticulum.

The fæces to play any active part must be very problematical, in view of the fluid nature of the contents of the small intestine.

De Quervain's²³ explanation, that a rush of fluid along the intestine produces a negative pressure in, and so invagination of, the diverticulum, we can disregard as being too fantastic.

The most reasonable explanation seems to me that the invagination starts at the base and not at the apex, as has been assumed. Slight torsions, the symptoms of which have been noted in many cases, produce congestion, swelling, and a quantity of mucus in the lumen of the diverticulum. Now it has been noted that the mucosa of this structure is loosely attached to the muscular wall (Watson Cheyne⁵), so loose is it that the mucous coat alone can be invaginated.⁵ The consequent swelling of the mucosa and its separation by serous effusion from the muscular coat (aided perhaps by bacterial infection) produce a closure of the orifice into the intestine, and efforts to expel the accumulated contents succeed only in squeezing the mucous coat into the intestine, which would ultimately drag after it the muscular and serous coats also. The invagination would thus start at the neck or base, and the swelling is progressive, on account of the contraction of the

circular fibres behind, thus tending to prevent a return to the normal condition. Intussusception of the intestine may follow immediately, or the mass may hang free in the intestinal lumen and give rise to recurrent attacks of hemorrhage, etc., symptoms which we have seen are often characteristic of these cases.

Repeated attacks of inflammation or mechanical congestion in such an invaginated diverticulum, if an intussusception is not produced, will cause the fusion of the now adjacent serous surfaces and an intestinal polyp is produced. I think this may be the real origin of some, at any rate, of the so-called high intestinal polyps, which are said to cause hemorrhage from the bowel and sometimes an intussusception. Specimens can be seen illustrating this transformation of an invaginated Meckel's diverticulum into an intestinal polyp, though more observations are of course necessary to establish such a statement (Jakch,¹³ Heller²⁰).

Prognosis—When acute symptoms have supervened, the prognosis is very grave, while, if operation is practised during the quiescent stage (or when symptoms are only subacute or chronic) the outlook is more hopeful. Thus of the two chronic cases operated on, one recovered and in one the result is not stated (Rehn¹ and Jakch¹³). No details are given of Boldt's case²⁴. The lesion was discovered at autopsy in two cases (Heller²⁰), death presumably occurring from other causes. Three cases are specimens only (Heller,²⁰ Treves²⁵). Of the 32 cases left, where an adequate clinical account is given, 13 recovered and 19 died, a mortality of nearly 60 per cent. Six cases were not operated on and only one of these, O'Connor's,²⁶ recovered by the sloughing of the whole intussusception, which was passed per rectum about the sixth or seventh day. Twenty-seven cases were operated on with 14 deaths and 13 recoveries—a mortality of about 52 per cent.

Of these 27 cases operated on *resection of intestine* was practised 15 times, with a mortality of 53 per cent, but it will be seen in the table that 9 of these cases were under 12 years of age, while over that age the mortality was 50 per cent. The mortality, therefore, in cases of resection appears to be

between 50 per cent and 60 per cent, independent of age, though such figures are not of very great value when calculated from so small a number of cases. *The diverticulum alone was removed* 5 times, with 3 recoveries and 2 deaths. And, considering that the age of 2 of the cases was over 5 years and of the other 3 between 10 and 20 years, 60 per cent mortality is a high figure, in view of the comparative insignificance of the operation. *Reduction of the invaginated diverticulum without subsequent removal* was practised in 4 cases, of which 3 recovered. The case which died is reported by Cawardine,²⁷ and here an intussusception had to be reduced also, while the age of the infant was 1 year and 2 months (mortality 25 per cent).

In two cases entero-anastomosis only, above and below the seat of obstruction, was practised with a mortality of 100 per cent, while in one case the obstruction, which the operation failed to relieve (Maroni²²), led to a fatal termination. It would seem, from the figures, that reduction only, where feasible, has given the best results, but it is questionable whether it is wise to leave the diverticulum, in view of the possible occurrence of future trouble.

Diagnosis—When an acute attack is at its height, the diagnosis has to be made from. (1) appendicitis, (2) volvulus, (3) tubercular peritonitis, and (4) intestinal stenosis.

It must be mentioned, however, that though the points previously referred to will often prove of considerable assistance in establishing a correct diagnosis, there is no one sign pathognomonic of invagination of Meckel's diverticulum—the recognition of the lesion must depend on the presence of a combination of signs, such as will be found only in a certain percentage of cases.

As an example, I will emphasize the importance of noticing the appearance of the umbilicus for any marked abnormality here (or a history of persistent discharge of pus or fecal matter in childhood) in conjunction with a typical history of recurrent abdominal crises, or with a palpable sausage-shaped tumor in a case where no blood has been passed per rectum,

would warrant the diagnosis of the lesion under consideration. It is unnecessary to again detail the signs already mentioned, for a combination of any of them may suffice to make a diagnosis probable, where the presence of all of them would render this probability a certainty.

From appendicitis the differentiation would depend on the past history, the age, the more gradual onset during activity, culminating in a climax of absolute constipation, the absence of marked local tenderness or rigidity, the character of the pain, etc., etc. The picture of acute appendicitis is quite different, while the recurring attacks of this disease are, as may be readily seen, of a typically different nature.

From volvulus ¹⁰ the diagnosis should seldom be difficult, for the age, the sudden and violent nature of the onset, and a consideration of the past history, in conjunction with negative signs, should suffice to render clear the nature of the case. In volvulus, if there have been recurrent attacks, recovery from these latter will usually be accompanied by the passage of a large quantity of flatus, whereas in invagination of Meckel's diverticulum flatulence is more usual.

From subacute (possibly merging into acute) obstruction, due to tubercular peritonitis, the diagnosis may be difficult, for recurrent colicky pains with the passage of blood and possibly mucus may make the case puzzling. The pronounced wasting in such tubercular disease, the frequently putty-like feces and the typical "feel" of such an abdomen, taken in conjunction with the absence of characteristic signs or history of the diverticular lesion, would be the main points of difference. My own case had been mistaken by the medical attendant for tubercular peritonitis.

Calmette's ophthaltmotuberculin reaction might be of assistance in some cases, though my own experience has been that this reaction is less reliable in abdominal than in other forms of tuberculosis.

One case has been mistaken for *intestinal stenosis* (Ewald ¹¹). No comment is required here, except to mention the association of intestinal stenosis or occlusion with hyper-

involution of the omphalomesenteric structures described by Bland-Sutton²⁸ The establishment of such a differential diagnosis will seldom be required, and would be made on general lines after a careful attention to details

Treatment —Wherever the diagnosis can be made before the occurrence of the final acute attack (and this should be possible in a certain number of cases) exploratory laparotomy with, if present, the removal of the Meckel's diverticulum, should be urged and performed During the acute attack resection may be necessary or complete reduction may be possible

In any case, in spite of the high proportion of recoveries recorded when the diverticulum has been left, it is correct treatment to remove this structure When the adjacent intestine is oedematous or gangrenous, there is considerable risk of the stitches giving, and in these cases it will be, I think, best to cover the sutures with an omental graft and provide efficient drainage against the possible occurrence of a fecal fistula. When the age and condition of the patient warrant resection of the intestine together with the attached gangrenous diverticulum with restoration by immediate anastomosis, this is the ideal and safest procedure, but this step will rarely be justifiable or wise in cases where reduction can so far be effected

In conclusion I would say that lesions resulting from abnormalities in the involution of the omphalomesenteric structures, of which invagination of Meckel's diverticulum forms a small part, deserve, from their diversity and severity, more attention than has hitherto been given them

BIBLIOGRAPHY

¹ Rehn, Verhandl d deutsch Gesellsch fur Chirurgie, 1904, 1, 259

² Forgue & Riche, Le Diverticule de Meckel, 1907

³ Gray, Brit Med Jour, 1907, 11

⁴ Smith, Annals of Surgery, 1904, xl, 743

⁵ Watson Cheyne, Annals of Surgery, 1904, xl, 796

⁶ Bidwell, Lancet, Sept 7, 1907

⁷ Betham Robinson, Brit Med Jour, 1899, 1416

⁸ Zum Busch, Clin Soc Trans, xxxvi, 213

⁹ Coffey, Annals of Surgery, 1907, xlv, 42

- ¹⁰ Kuttner, Beitr zur klin Chir, 1898, xxi, 289
- ¹¹ Ewald, Berliner klin Wochenschrift, 1897, No 8, 169
- ¹² Strauch, Zeitschrift fur klin Med, 1899, xxxviii, 465
- ¹³ Jakch, Deutsche Zeitschrift fur Chirurgie, 1907, lxxlvii, 192
- ¹⁴ Terry, Lancet, 1903, i, 961
- ¹⁵ Wainwright, Annals of Surgery, 1902, xlxv, 32
- ¹⁶ Kelly, Quoted by Gray, *ibid*
- ¹⁷ Adams, Trans Path Soc, London, 1892, xliii, 75
- ¹⁸ Weill & Frankel, Bull Soc Anatomique, 1896
- ¹⁹ Von Mandach, Lancet, Dec 14, 1907, 1733
- ²⁰ Heller, Quoted by Watson Cheyne, *ibid*
- ²¹ Brunner, Beitr zur klin Chir, 1899, xlv
- ²² Maroni, Virchow u Hirsch Jahresbericht, 1887, ii, 515
- ²³ De Quervain, Centralblatt fur Chirurgie, 1898, xlv
- ²⁴ Boldt, Med Record, April 14, 1900
- ²⁵ Treves, Intestinal Obstruction, 1901
- ²⁶ O'Connor, Brit Med Journal, 1894, ii, 123
- ²⁷ Cawardine, Lancet, 1904, i, 505
- ²⁸ Bland-Sutton, Quoted by Gray, *ibid*
- ²⁹ Holbeck, Archiv fur klinische Chirurgie, 1900, lxi
- ³⁰ Von Strubenrauch, Quoted by Watson Cheyne, *ibid*
- ³¹ Travers, Lancet, 1902, ii, 1906
- ³² Morrison, Lancet, 1901, ii, 1047
- ³³ Pitts, Brit Med Jour, 1901, ii, 579
- ³⁴ Eve, Brit Med Jour, 1901, ii, 583
- ³⁵ Erdmann, Annals of Surgery, February, 1900, xxi, 186
- ³⁶ Ingle, Brit Med Jour, 1888, i, 648
- ³⁷ Bayer, Centralblatt fur Chirurgie, 1900, xlvii, 1138
- ³⁸ Adams, St Bartholomew's Hosp Rep, xlvii, 1891
- ³⁹ Studsgaard, Quoted by Watson Cheyne, *ibid*
- ⁴⁰ Guyot, Quoted by Forgue and Riche, *ibid*

PERITONITIS IN CHILDREN FROM UNKNOWN SITES OF INFECTION.*

BY CHARLES N. DOWD, M D,

OF NEW YORK,

Attending Surgeon to the General Memorial Hospital and to St Mary's Hospital
for Children, Associate in Surgery, College of Physicians and Surgeons

THERE are certain phases of peritoneal inflammation in children which differ enough from those ordinarily found in adults to justify their special consideration. Children are more likely to have rapidly spreading, insidious forms of peritonitis than are adults, since they are less likely to encapsulate the inflammation. They are much less likely to be constipated during its course, and hence have less of that tympanites which is so hard for the patient, but which is a telltale to the doctor. They are much more likely to have associated cerebral symptoms, so that very competent observers are sometimes at a loss to know whether a given case is to be considered as primarily cerebral or abdominal. Again, pulmonary inflammation is often accompanied by localized abdominal pain and rigidity, so that children with beginning pneumonia are believed to have appendicitis. Pneumococcus peritonitis, either isolated or associated with other pneumococcus inflammations, is much more common in children than in adults. General gonococcus peritonitis is occasionally found. Tubercular peritonitis is common, and sometimes presents symptoms which are most difficult to interpret.

The particular form of peritonitis to which this paper refers is usually due to streptococcus infection. It spreads with great virulence through the abdomen; it is not easy of diagnosis, and is not associated with any discoverable site of infection. The following cases illustrate the subject.

CASE I—A child of seven years, who was one of the Central American Indians sent to this country for education,

* Read before the New York Surgical Society, Oct 14, 1908

was admitted to St Mary's Hospital, February 14, 1906. She had been ill for four days in her school with persistent vomiting and prostration, and was sent in with a diagnosis of gastritis or possibly typhoid fever. Her temperature was 102° , pulse 128, respiration 28. Her abdomen was tense, but was not distended. There seemed to be no point of particular tenderness, but the amount of rigidity indicated that there was an abdominal lesion. Rectal examination showed moderate tenderness on both sides, in about equal degree. Her bowels had moved with an enema. She was admitted to the Medical Division and on admission impressed the House Physician, as she had the school physician, as not being critically ill. On the next day, however, when Dr Swift and I saw her, she seemed ill enough. Temperature 102.6° , pulse 154, respiration 36, 80,000 leucocytes, 94 per cent polynuclear. Exploratory laparotomy was done without delay and a general peritonitis was found, with an excessive amount of pus and fibrin throughout the peritoneal cavity. The appendix seemed no more inflamed than the rest of the intestine. Streptococci were found in the pus and pure culture. There was no evidence of primary lesion. The patient died twelve hours later.

CASE II—This case, a resident of a neighboring town, through her illness of a week illustrated a similar condition. She was three years old, was in good health until March 11, when she began to have a little fever. Next morning she vomited and her temperature went to 102° . It quickly reached 104° and stayed at about that point for a week. She vomited little during the week, and cathartics and enemas were necessary but effectual. She had an otitis media and the drum head was incised. On the night of March 17 she began to vomit persistently, and had abdominal distention. On the next morning, which was the time when I first saw her, she was in a most serious condition. She gasped and kept her mouth moving as if swallowing. Her temperature was 105° , pulse 150, respiration about 30. No lesion could be found outside of the abdomen, and even the abdomen, which was examined after a stomach washing, showed no marked rigidity. What rigidity there was, was rather less than that frequently seen with pneumonia, and was not localized, nor could any localized inflammation be made out by bimanual examination. Operation did not seem advisable. Later in the day another consultant was called from the city. He found the child's eyes

crossed, with an irregularity of the pupils, spasm and rolling of the head, and thought meningitis was present. The child, however, died in a few hours, and on autopsy acute general streptococcus peritonitis was found, with much fibrin and pus. There was no evident source of infection.

CASE III —Another example of a similar condition was given by a girl, ten and a half years old, who came into St. Mary's Hospital after an illness of a week which began with sharp knife-like pain in the region of the umbilicus. This pain soon extended through the whole abdomen, and was accompanied by nausea and vomiting. She is said to have improved under treatment in bed for four or five days, then was seized with a chill and the abdominal pain increased, and within a few hours she was brought to the hospital with symptoms of general peritonitis. Operation was done immediately and a large amount of free whitish pus was found. The intestines were covered with thick layers of fibrin. The inflammation in the region of the appendix and right tube was slightly more marked than that in other parts of the abdomen, and the appendix was removed, but there was no evidence of perforation, it seemed about like the rest of the intestine. Bacteriological examination showed pure cultures of streptococci in chains of medium length.

She died on the following day and the autopsy showed general peritonitis, which involved the lesser as well as the greater peritoneal cavity. There was no evident source of infection.

It may be well here to refer to a case which Holt^{*} has recorded.

A baby of six months was apparently absolutely healthy until twenty-four hours before admission to the hospital. She then showed general irritability, slight fever, four attacks of vomiting, and passed several thin green stools. By evening the mother was so alarmed that she took her to the hospital,—about eleven o'clock. The child looked ill, but was well nourished. Temperature 102°, pulse 120, respiration 30. Abdomen slightly fuller than normal, not distended. No apparent tenderness, no masses present. Rectal examination negative. She died early the next afternoon, having diarrhoea, vomiting and collapse.

Autopsy—Acute diffuse streptococcus peritonitis. No perforation of stomach or intestine. Appendix normal. No apparent site of infection.

* Archives of Pediatrics, '03, p. 278

The autopsy was done two hours after death. No lesions of importance were found excepting in the abdomen, and the abdominal viscera themselves were normal, but there was acute diffuse peritonitis of recent origin, with four to six ounces of turbid fluid containing flocculi of fibrin and pus, patches of fibrin on intestine and on liver and spleen. No perforations of stomach or intestines. Appendix normal. Cultures. Peritoneal exudate, liver, spleen and heart's blood gave streptococcus brevis.

NOTE (by Dr Holt) — "Careful inquiry gave no clue as to origin of infection.

Few conditions are more obscure than acute peritonitis in infancy. Without autopsy in this case the condition could not have been recognized.

Most of the cases which have come under my observation have been of longer duration and have presented more marked tenderness, distention and vomiting. I have, however, records of at least half a dozen examples of acute peritonitis in infants (suppurative) where the origin was as obscure as in this instance.

Appendicitis is of course to be suspected in infants, as in adults, but there is no evidence whatever in this case that the appendix was involved."

MARTIN, of Philadelphia, (ANNALS OF SURGERY, Dec, '06, p 917) records a similar case, aged 9 years. Generally miserable for two weeks. Pain, vomiting and diarrhoea for twenty-four hours. General abdominal tenderness on admission, with moderate muscular rigidity. Leucocytosis of 60,000. Operation. General streptococcus peritonitis without apparent site of infection. Death in three days.

MONKS (ANNALS OF SURGERY, June, 1908, p 964) in describing his technique of bowel washing refers to a similar case, a child of eight years with streptococcus peritonitis without assignable cause.

BONNET (*Lyon Medicale*, Nov 25, 1906) records the case of a child who died of purulent peritonitis, believing that the source of infection was a facial erysipelas which the mother had.

OPPENHEIMER (*Deutsch Ztschr Chir*, '06, v 83, p 456) describes streptococcus peritonitis in a child as an accompaniment of a widely spread and most virulent erysipelas.

ROSSI (*Archiv Ped*, '04, p 395) reports one case, and refers to three others, in addition to the seven which Dieulafoy had already referred to.

I know of other cases, which have occurred in the practice of my friends, which I am not at liberty to quote, and without doubt large numbers can be quoted from literature, but these are enough to call attention to the existence of this peculiar type of peritonitis.

Kerley in his recent book, "Treatment of Diseases of

Children," relates that he has seen four cases within a year, and that medical treatment in his experience was without value, since every case ended fatally. In the majority surgeons were called in consultation, but invariably advised against operation. Never having had a case recover, he states that he is not in a position to advise treatment.

However, there is surely a certain proportion of cases for whom an early operation is helpful. If the infection happens to be a *coli communis* infection instead of a streptococcus infection, operation may be very helpful, as is illustrated by the following case:

CASE IV—T McE, aged 10, came into St Mary's Hospital April 9, 1907, having had an attack of pain in the right side of his abdomen about three weeks previously. This subsided so that he was able to go to school, but apparently he had never felt absolutely well. On the day of admission to the hospital the pain had been severe enough to cause him to leave school. He had marked rigidity in the upper right side of the abdomen and severe pain just below the costal border. Palpation of the appendiceal region showed no marked rigidity or tenderness. There was no abdominal distention. There had been no vomiting. His bowels moved with enemas.

An exploration revealed slight diffuse peritonitis. The intestines were everywhere red and congested, and there was a moderate amount of free fluid, slightly turbid, and a slight fibrinous deposit. The omentum was grayish in appearance. There were a few fragile adhesions to the right of the duodenum and about the head of the colon, excepting for these evidences of inflammation, the stomach, duodenum, gall-bladder, appendix and intestines appeared normal. The appendix was removed as the most probable site of infection. A culture from the fluid gave a growth of *coli communis*. The boy's symptoms promptly subsided and he made a good recovery. The appendix was put in alcohol, and when I studied it in detail on the following day I could force a little bubble through its wall near the tip, although there had been no evidence of a perforation there. I took this to indicate that there was a thin place there which probably had furnished the spot of exit of the infection.

In studying these cases we find that they have not presented the elements for an early diagnosis, principally because abdominal rigidity, either localized or general, is the most important symptom in making such a diagnosis in peritonitis, and this symptom has been wanting or only moderate in degree. It may, however, be an aid in similar cases to remember that this type of peritonitis is not very rare, that the symptoms are usually indefinite, that there is usually excessive vomiting, prostration, without tympanites, marked rigidity or constipation, diarrhoea often being present. The three streptococcus cases which are here recorded all had excessive vomiting, profound prostration and diarrhoea. The coli communis case was much less virulent and gave signs of a peritonitis localized in the right hypochondrium, with no particular difficulty in diagnosis.

The type should be especially considered among children's diseases because of the symptoms, which differ materially from those of adults, and because it occurs so much more frequently in children than in adults.

The studies of Oppenheimer (*loc cit*), Noetzel (*Berl klin Chr*, 47, 241), Clairmont and Ranzi (*Archiv f klin Chr*, 68-76), which covers 1149 cases of peritonitis, indicate great rarity of peritonitis without assignable site of infection in adults.

Besides a clinical interest in this type of peritonitis, there is a scholastic interest as to the manner of infection. It is believed that the infection usually takes place by the passage of the germs through the intestinal wall. There is an extensive literature on this subject. I will only refer to three observers.

Bond (*Brit Med J*, '06, 11) has carefully reviewed the subject and calls attention particularly to the infection which exists in hernial sacs as showing the passage of germs through the intestinal wall. Where there is a combination of distended bowels with retarded blood supply, of fecal culture media in the intestine and of virulent organisms, there is a strong likelihood that peritonitis will result. This condition is more likely

to occur in the appendix than in any other part of the intestine, and the wall of the appendix is less likely to resist the passage of the germs.

Jensen (*Archiv f klin Chirurgie*, 1903, vol 69, 1134; vol 70, 91) studied pneumococcus peritonitis, and among other experiments he fed four animals on virulent cultures of pneumococci in capsules. One of the animals died with pneumococcus peritonitis, and at the autopsy he found follicular enteritis with slight necrosis of Peyer's patches, but no ulcer and no perforation. The pneumococci were found in the intestinal canal, the intestinal wall, the blood and the peritoneum.

Flexner (*Johns Hopkins Bulletin*, 1895) found diplococci within the lumen of the intestine, in its wall nearly to the muscularis mucosa, and within the peritoneum, and also in spaces where he believed the lymphatics furnished the avenue of transit into the peritoneal cavity.

DIFFUSE SEPTIC PERITONITIS, DUE TO APPENDICITIS

WITH REFERENCE TO AFTER-TREATMENT WITH POSTUPAL DRAINAGE.

BY ROYALE HAMILTON FOWLER, M D ,

OF NEW YORK CITY,

Intern at St. Luke's Hospital

FROM July 1, 1898, to January 1, 1908, there were treated in this hospital, exclusive of the service of Dr. Robert Abbe, 69 well-marked cases of diffuse septic peritonitis, *i e*, cases in which the entire greater sac was involved. Care has been taken to exclude from this series all lesions which might possibly have been interpreted as spreading processes, by which is meant an inflammation located in one quadrant or half of the abdominal cavity not confined by adhesions. An analysis of the cases occurring during these successive years has been undertaken.

1898 Four cases were operated upon (one case not included died on the table before the abdomen was opened), 100 per cent succumbed to combined shock and sepsis. All but one case, which survived five days, died during the first twenty-four hours. The earliest operative interference was instituted on the third day of appendicitis, the latest on the seventh day of the disease.

Operative Procedure—(1) Incision. Preference was given to multiple incisions, seven and one-half centimetres, with openings for counter-drainage in both flanks. The manner of dealing with the appendix need not detain us. (2) Flushing. Irrigation of the peritoneal cavity with normal salt solution at a temperature of 110° F was practiced in all four cases, the septic material being sponged away and dried. (3) Drainage. To dismiss this subject summarily, all the cases observed over a period of ten years were drained. In cases in which multiple openings were made, each incision received a tube of glass or rubber (for the most part rubber).

with an iodoform gauze wick directed down into the pelvis, up toward the diaphragm or among the intestinal coils. In other cases a Mickulitz or a *cigarette* drain was employed, and incision partially sutured in the usual manner.

After-treatment —The after-care covering the four cases of 1898 was as follows: Immediately following operation but small quantities of water were given by mouth, later restricted fluids. The wound was dressed each day and irrigation through the drainage-tubes practiced with hot normal salt solution. Saline enemas were administered to be retained, every one or two hours for three injections, or continuous saline irrigation every four hours for fifteen minutes was given. Stimulating and nutrient enemas were given. Lavage for persistent vomiting was resorted to and either castor oil or magnesium sulphate left in the stomach.

1899 Eleven cases were operated upon, all but one died, succumbing to causes other than complications, making a mortality of 90.9 per cent. The case which survived was operated upon on the third day of the disease, as were four others. The earliest mechanical intervention was on the third day, the latest on the twenty-first day of the disease. Of the remaining six fatal cases, one received operative treatment on the twenty-first day, one on the eighth, one on the seventh, one on the sixth, one on the fourth, and one on the second day of the disease. Of the ten deaths, seven occurred during the first twenty-four hours, one on the second day following operation, one on the third and one on the fourth.

Operative Procedure —(1) Incisions were slightly larger, multiple in all cases for counter-drainage. (2) Flushing was practiced in eight cases, in three it was not. The single case which recovered was irrigated.

After-treatment —In brief it was as in the preceding year. Magnesium sulphate was occasionally added to the saline irrigation of the rectum. Oil enemas and the usual medicated enemas were given (magnesium sulphate, ox-gall, turpentine, glycerine, etc.) In one case, salts were injected into the intestine, as recommended by Dr McCosh. One case received

magnesium sulphate (two drachms) every hour by mouth for four doses Calomel in serial or single doses was given on the first or second day following operation Croton oil was used in a few isolated cases, one minim on the tongue, or in some cases given in the enema In addition to usual stimulants as heretofore employed, Credé's inunction found favor in some cases

1900 Eight cases were operated upon with but two recoveries (mortality of 75 per cent) Of these recoveries one was treated by operation on the first day and was discharged cured in thirty-three days, the other was operated upon on the third day and was discharged cured in thirty-six days Of the six fatal cases, three survived the twenty-four hour period, death occurring on the third to the fifth day from combined shock and sepsis Three died within the first twenty-four hours without complications

Operative Procedure —(1) In the majority of cases a seven and one-half centimetre intermuscular incision was made directly over the appendix, in a few a median incision, in all cases multiple incisions for counter-drainage Puncture of the transverse colon was made in one case with subsequent suture (2) Six cases were irrigated and two were not The two cases which survived were flushed out in the manner described

After-treatment —(1) The wound received attention as heretofore, and was irrigated through the drains with half strength borosal solution No new or other method of treatment not already described was employed (2) Postural drainage In April of this year Dr George Ryerson Fowler¹ published an account of the advantages of the Elevated Head and Trunk Position Of eight cases occurring in this hospital in 1900, this method of treatment was adopted in one case with one death In this case the trunk was elevated on the operating table during irrigation of the peritoneal cavity The patient was in extremis when brought to the hospital and profoundly septic, and died three days after operation Of seven cases not treated by postural drainage two recovered

¹ Med Rec, vol lvi, No 15, p 617, 1900

1901 Five cases were operated upon with two deaths (mortality of 40 per cent) Of the three cases which recovered, one received operative treatment on the third day, one on the seventh and one on the thirteenth day of the disease The average stay in the hospital was sixty-four days The longest period of convalescence was seventy-four days, being protracted by an enterostomy The two deaths, one occurring on the third day and one on the fourth day, were attributed to sepsis and shock independent of intercurrent affections

Operative Procedure —(1) Incision as before over the appendix, sufficiently large to deal satisfactorily with the organ (2) Flushing Lavage of the peritoneum with normal salt solution was done in four cases Two patients recovered

After-treatment —(1) Consisted in such measures as hitherto practiced with the following exceptions Six cases received irrigation through the drainage tubes, some with borosal (one-half strength), others with hydrogen peroxide followed by normal salt In one case an incision was made into the intestine two days after operation, the contents evacuated and the incision closed by suture In two instances an enterostomy was performed, one died, the other was cured (2) Postural drainage The bedside notes indicate that this treatment was carried out in but one case The patient recovered

1902 Two cases were operated upon with two deaths In these cases death was due to shock and sepsis, in one, operation was undertaken on the second day, this case survived two days, and in the other case on the third day This case succumbed on the eighth day after operation

Operative Procedure —(1) Incision Single incisions $7\frac{1}{2}$ to 15 centimetres long (2) Flushing was practiced in one case

After-treatment —Rectal irrigations, enemas, etc, as before In one case an inguinal colostomy was performed on the tenth day after operation and the intestine irrigated This was followed by continuous irrigation of the rectum up to the time

of death Postural drainage The nurses' notes fail to state that advantage was taken of the postural position

1903 Four cases were treated by operation and four deaths occurred, exclusive of complications

Operative Procedure —The cases were in extremis at time of operation Multiple incisions were made for counter-drainage, effected by rubber tubes as heretofore Two cases were irrigated, two were not

After-treatment —(1) This differed in no way from the ordinary routine of the preceding years In one case the cæcum was incised, the contents evacuated, followed by instillation of magnesium sulphate and oleum tigli (2) Postural drainage was instituted in four cases

1904 Ten cases were operated upon with three recoveries (70 per cent mortality) The average period of convalescence was twenty-eight and one-half days Of seven fatalities all cases survived twenty-four hours, except one which died on the table

Operative Procedure —Incisions were multiple and single from 7 to 15 centimetres Irrigation was performed in eight cases, in two it was not Two cases irrigated recovered, as did one case which was not

After-treatment —(1) In general terms, as previously indicated Two of the three cases of favorable termination received irrigation through the drainage-tubes, also magnesium sulphate by mouth In one fatal case the management was, in addition to that indicated, injection of magnesium sulphate into the bowel after the manner of McCosh (2) Postural drainage was instituted in six cases with three recoveries, in four it was not One case of the latter died on the table

1905 Seven cases were operated upon with four deaths, a mortality of 57.1 per cent An average of thirty-eight and one-half days' convalescence is noted Of the fatalities, all due to shock and sepsis, two occurred within twenty-four hours after operation One lived three days and one six days after operation

Operative Procedure —Three favorable cases (1) In-

termuscular incision with Mickulitz drain. (2) Seven centimetre intermuscular incision with gauze drain (3) Incision at outer border of rectus muscle, with rubber tube drain The fatal cases received multiple incisions or a 15 centimetre single median incision, with rubber tube drainage, except one which had *cigarette* drainage Flushing was practiced in four cases with two recoveries, in three it was not, with one recovery

After-treatment —(1) The three cases terminating in recovery were irrigated with borosal (one-half strength) This was practiced in one of the four fatal cases Eserin salicylate was given in one case with recovery and in two cases with two deaths The other details were as given above (2) Postural drainage was used in the three cases which recovered and in two of the cases which died One of the latter was in extremis before operation and succumbed just after the first twenty-four-hour period Two died that did not receive postural drainage

1906 Seven cases were operated upon with five deaths (71.4 per cent mortality) The two cases which were cured left the hospital on the thirtieth and sixtieth day respectively Of the fatal cases, one died two hours after operation, performed on the fifth day Another case also operated upon on the fifth day survived twenty-four hours, two lived two days, one operated upon on the first day and the other on the third day of the disease

Operative Procedure —(1) Incision Seven-centimetre intermuscular incision in the right iliac region was made in two favorable cases, the same was performed in the remaining five, except two which received multiple incisions Flushing. Three cases were irrigated, with two deaths, and four were not, with three deaths

After-treatment —The main features were as given in the previous years Postural drainage Four of the seven cases were placed in the semi-sitting posture, with two deaths; one was in extremis before operation and survived but two

hours Three deaths occurred in three cases not treated in this way

1907 Eleven cases were operated upon with four deaths (36·3 per cent mortality) The operation was performed on the second day, thirty-sixth hour, third, fourth, fifth, sixth, and seventh day respectively in the cases terminating in recovery The average stay in the hospital was forty-one and one-half days, the longest necessitated by the development of a secondary pelvic abscess Of the fatal cases, two were operated upon on the second day, one of these developed four days later intestinal obstruction, angulation freed by operation, and one day later, fifth day after original operation, an enterostomy was performed The patient died on the ninth day of shock and sepsis The other case died on the second day after operation Of the two remaining fatal cases, death occurred in one, on the third day, and in the other twenty-four hours after operation

Operative Procedure — (1) Incision Seven and one-half centimetre intermuscular incision in all cases A secondary operation was necessary to free a kink giving rise to intestinal obstruction on the fourth day after operation in one case, on the fifth day an enterostomy was performed (2) Flushing was carried out in ten cases, with three deaths, in one it was not, with one death Postural drainage was instituted in all cases

After careful consideration of these cases and the results of others, the following conclusions are reached

1 We must look for a lowering of the high mortality rate in early operation, rather than in any further development in mechanical intervention Dr Blake's² statistics in spreading peritonitis show a mortality of 14·3 per cent (21 cases)

2 Early institution of postural drainage This is of greater aid in preventing septic material from reaching the diaphragmatic peritoneum than in preventing further absorp-

² Treatment of Diffuse Septic Peritonitis, N Y and Phila Med Jour, Nov 19, 1904

tion after this area is once involved. Ambulance cases of peritonitis of this nature are frequently brought to the hospital in the sitting posture. The trunk should be elevated during lavage of the peritoneum. The manner of instituting postural drainage matters but little, provided that the pelvis is sufficiently low for gravitation to take place, and the patient is comfortable. At the German Hospital in Brooklyn a wooden frame is employed to raise the head of the bed, and a folded pillow beneath the knees, held in place by a bandage, prevents the patient from slipping. This secures an elevation of seven, thirteen or twenty inches as desired. At St. Luke's, Manhattan, a bed-rest is often employed, such as is used for cardiac cases, and the head of the bed elevated. At St. Luke's Hospital in Richmond, Va., a wooden frame is used to support the patient who lies upon a flat mattress, the head of the bed being elevated. Swings, blocks, hammocks, shoulder rests, etc., have been used for this purpose. It is difficult to maintain some patients, who are under mental strain, in the semi-sitting posture, in such cases muscular tension may be relaxed by having the patient lie flat, they are frequently unconscious of the elevation when well supported by a pillow or protected wooden rest.

3 Peritoneal lavage dilutes septic material, and when practiced should be continued until the cavity is partially closed. Plastic lymph not removed by irrigation or by simple lifting should not be disturbed.

4 Wound drainage. All cases of this nature should be drained. The ideal method, in women, is by a posterior colpotomy incision, by means of a large rubber tube. Cases not drained frequently develop pus pockets and superficial wound infections.

5 Ochsner's treatment should be instituted after operation and Murphy's proctoclysis practiced.

6 Open the abdomen by a small incision over McBurney's point, deal quickly with the primary focus, prevent evisceration and use greatest gentleness in handling parts.

The writer wishes to thank Dr. B F Curtis and Dr C L Gibson for permission to report these cases

ANALYTICAL TABLE

Year	Cases	Deaths	Mortality	Irrigated	Deaths	Not Irrigated	Deaths	Postural Drainage	Deaths	No Postural Drainage	Deaths	Enterostomy	Deaths	Mortality
1898	4	4	100%	4	4	0	0	0	0	4	4	0	0	93.3%
1899	11	10	90.9%	8	7	3	3	0	0	11	10	0	0	
1900	8	6	75%	6	4	2	2	1	1	7	5	0	0	62.9%
1901	5	2	40%	4	2	1	0	1	0	4	2	2	1	
1902	2	2	100%	1	1	1	1	0	0	2	2	1	1	
1903	4	4	100%	2	2	2	2	4	4	0	0	0	0	
1904	10	7	70%	8	6	2	1	6	3	4	4	0	0	
1905	7	4	57.1%	4	2	3	2	5	2	2	2	0	0	
1906	7	5	71.4%	3	2	4	3	4	2	3	3	0	0	
1907	11	4	36.3%	10	3	1	1	11	4	0	0	1	1	
Total	69	48		50	33	19	15	32	16	22	18	4	3	
Mortality	69.5%			66%		78.9%		*50%		*81.8%		75%		

* Statistics since 1900, i.e., adoption of postural drainage

THE INTERLOCKING SUTURE.

BY RAYMOND CUSTER TURCK, M.D.,

OF JACKSONVILLE, FLA

IN 1903 the writer reported a modification of the Connell suture for end-to-end intestinal anastomosis¹ In that paper attention was called to the results obtained in something over two thousand abdominal operations upon living dogs, performed at the Chicago Post-Graduate Laboratory of Anatomy and Operative Surgery, under aseptic conditions In the discussion of the various forms of intestinal suture, mention was made of the fact that 35 per cent of dogs died of a peritonitis resulting from leakage between sutures, in operations where the interrupted Lembert suture was used

Later work has fully confirmed the above findings It must be stated, however, that the large mortality in Lembert operations upon the dog does not apply to like procedures upon the human, the human peritoneum being much less susceptible to fatal peritonitis from leakage or infection than that of the dog, and while the interrupted Lembert has been practically abandoned in abdominal work upon the dog, yet that form of suture is still used upon the human intestinal tract with but an occasional death from peritonitis, the result of leakage

The primary Lembert principle, that of inversion of cut edges and union of relatively broad peritoneal surfaces, has not, however, as yet been improved upon, improvement having been only in the manner of the application of that principle

The first form of modification, that is, the Czerny-Lembert suture, is stronger and less liable to leakage than the Lembert alone, even when the Lembert is used in double rows

The second modification form, the double Lembert (*i e.*, Halsted's mattress suture) is not only more rapidly inserted,

¹ Modification of the Connell Suture, Journal of the Amer Medical Assoc, March 7, 1903

because of one knot for each two sutures, but it lessens the danger of leakage between sutures by exactly one-half, and so far as rapidity of insertion, strength, and safety are concerned, for general use on the human, it is perhaps the most practical application of the Lembert principle. As will be considered later, however, to insure against ordinary leakage, because of the longitudinal as well as lateral tension, the Halsted mattress sutures must be inserted much more closely together, than when the single Lemberts are used.

Wherever a continuous suture is advantageous, the continuous Lembert, (*i.e.*, the Cushing stitch, the Dupuytren modification, or the Richardson suture, in all of which the needle bites are taken not parallel but at right angles to the line of union), affords the greatest rapidity of insertion, as well as practical insurance against leakage, strength only, as in all continuous sutures, being the wanting factor.

In end-to-end intestinal anastomosis by the Connell method, the mortality in 400 operations upon dogs was reported by the writer, in 1903, as a trifle less than 3 per cent. In this recorded series the work was done by the Post-Graduate Faculty, by students working under a demonstrator, by independent investigators, and by students working alone. The mortality directly traceable to the Connell anastomosis in operations performed by experienced men was less than one-half of one per cent.

While the Connell operation apparently fulfils every indication in end-to-end anastomosis, yet it is not applicable to many operations encountered in visceral surgery. The Czerny-Lembert, the closely placed Halsted, the continuous Cushing, the Richardson, the double row of continuous overhand sutures, or the Murphy button fulfil nearly every other indication.

Conditions are encountered, however, in which not only strength of suture, but positive insurance against leakage is wanted, ease and rapidity of suture insertion, while desirable, being of secondary consideration.

As a fulfilment of this indication the writer devised and

reported an interrupted interlocking mattress suture² This suture is a modified Halsted, embodying all the advantages of the Lembert principle, and, if properly inserted, is absolutely proof against leakage

Consideration of the ordinary Halsted sutures demonstrates (Fig 2) that when the sutures are tied there is a pull in two directions, viz, at right angles to the line of union, and parallel to the line of approximation It will be noted that in tying the knots, the spaces between sutures are increased,

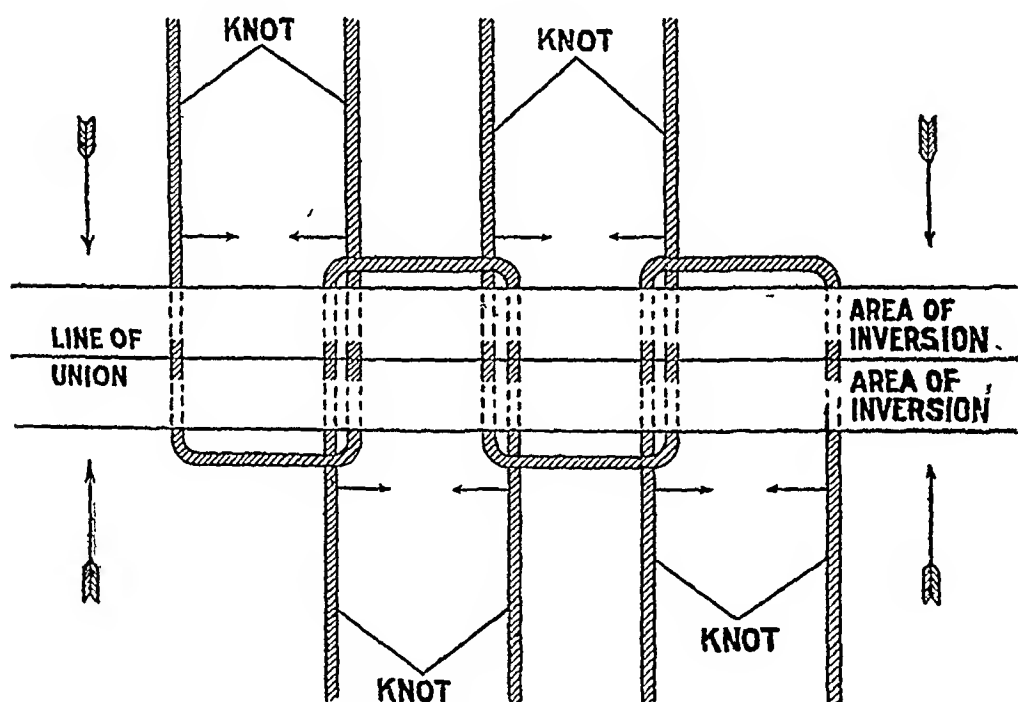


DIAGRAM 1—Interlocking suture with knots alternating on each side of line of union
Arrows indicate direction of suture tension Lembert principle of inversion

the danger and probability of leakage increasing accordingly In fact, observation of operations upon dogs demonstrated that when single Lemberts and Halsted mattress sutures were inserted with equal spacing, the percentage of leakage peritonitis was greater with the Halsted than with the Lembert To obviate this danger, and at the same time to utilize the clear advantages of the Halsted stitch, the halves of the Halsted's were placed slightly further apart, while the different

² An Intestinal Suture, Journal of the American Med Assoc, Jan 27, 1900

sutures were inserted as closely together as possible. As a result of this method, no leakage occurred in operations upon the small bowel, peritonitis resulted, however, in a few cases of colonic resection.

The next step was naturally an overlapping of the mattress sutures, and from this the interlocking stitch was evolved. In a word the interrupted interlocking suture is but the Halsted mattress suture, overlapped and interlocking, forming, when all knots are tied, a complete chain of stitches through which no leakage is possible. The suture can be inserted with knots alternating on each side of the line of union (Diagram 1)

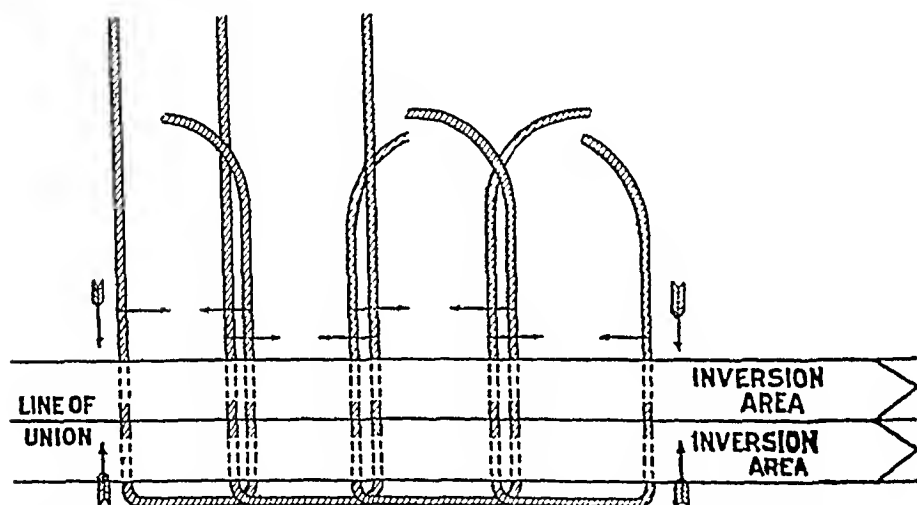
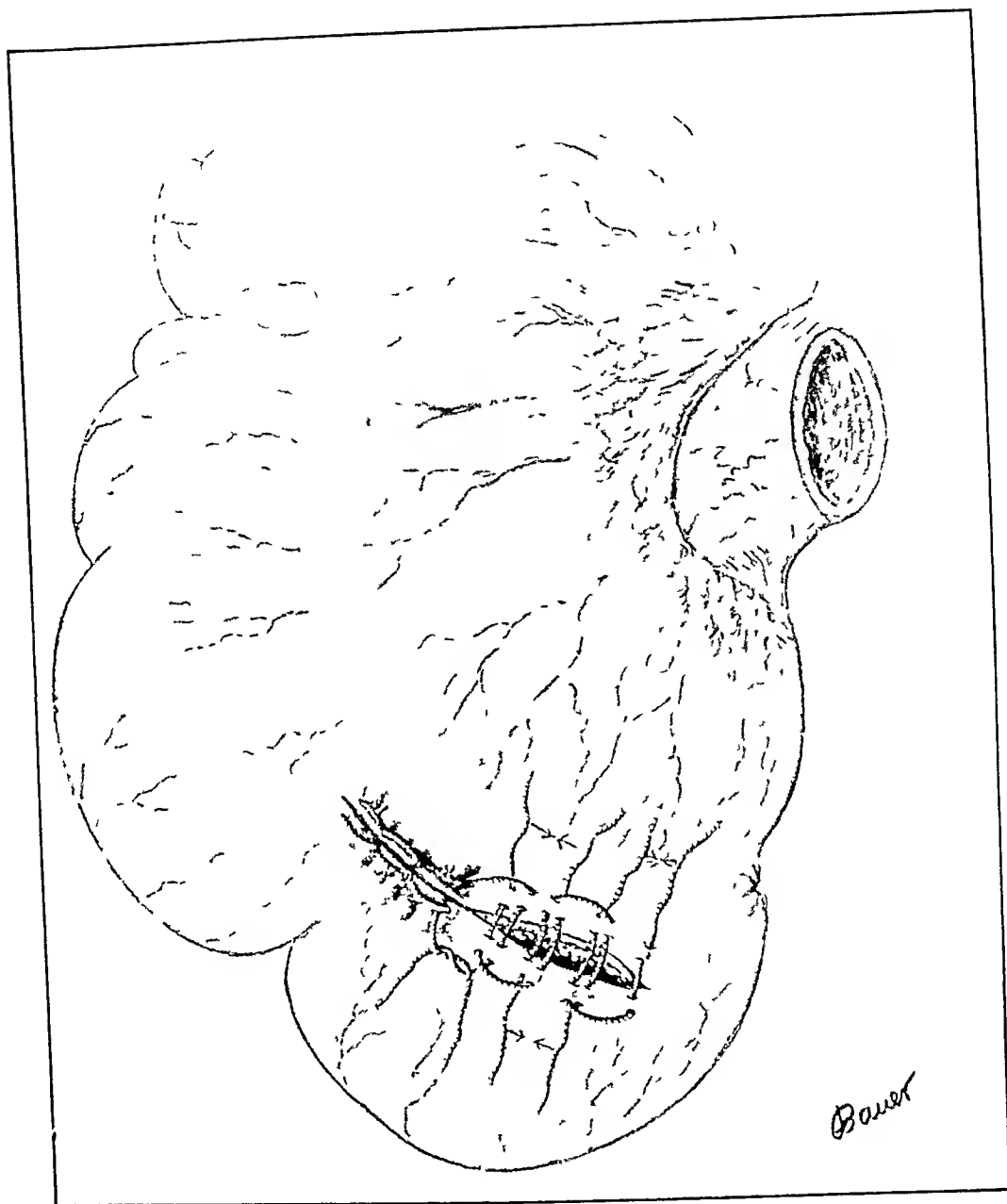


DIAGRAM 2 —Interlocking suture with knots on one side of line of union. Arrows indicate direction of suture tension. Lembert principle of inversion.

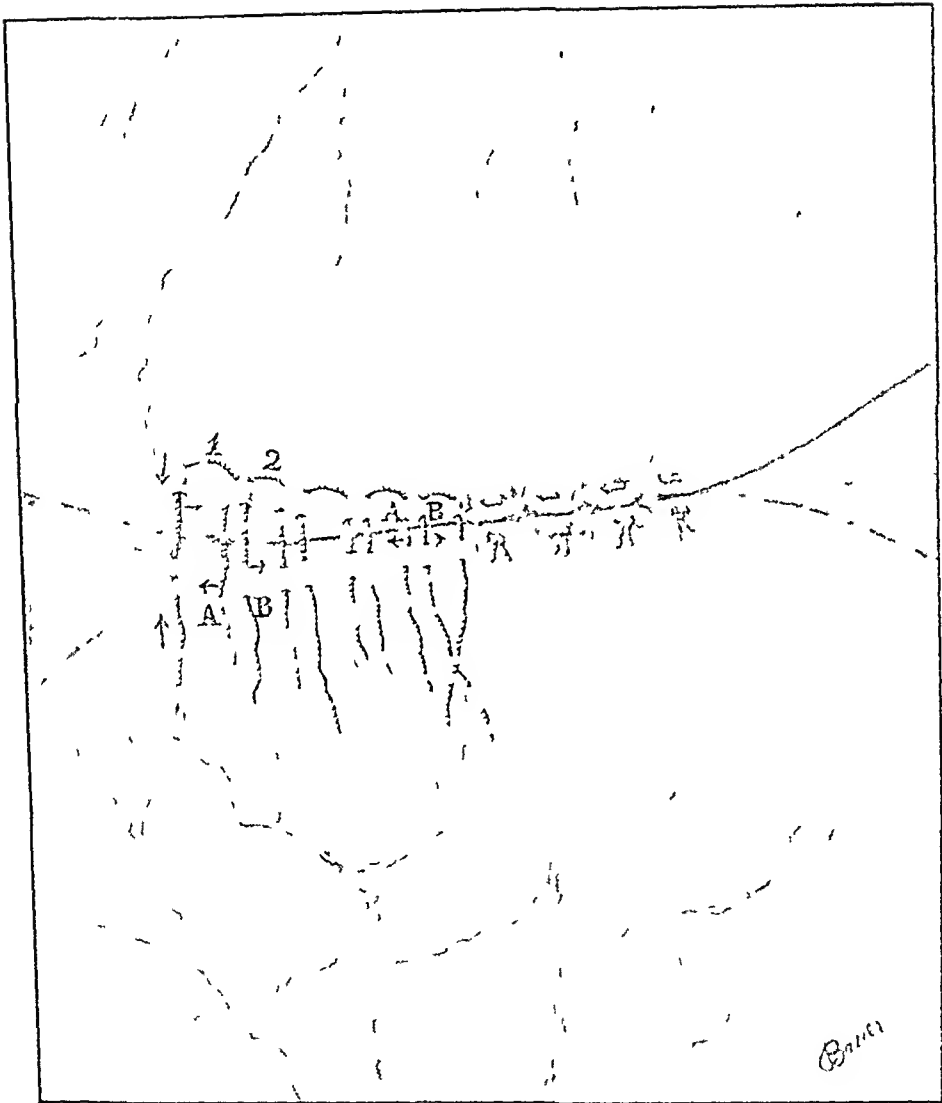
or with knots all on one side (Diagram 2). In either case but slight overlapping is necessary, though care should be taken in both instances that the first half of each succeeding suture passes *under the loop* and *over the loose end* of the suture immediately preceding, so that when all knots are tied a complete chain of stitches is formed (Figs 1 and 3).

A glance at the diagrams, and consideration of the direction of suture tension as indicated by the arrowheads, demonstrates that there are no non-approximated points in the line of union, and that *stitch leakage*, barring a slough, is *entirely eliminated*. So far as strength is concerned, because of the

FIG 1

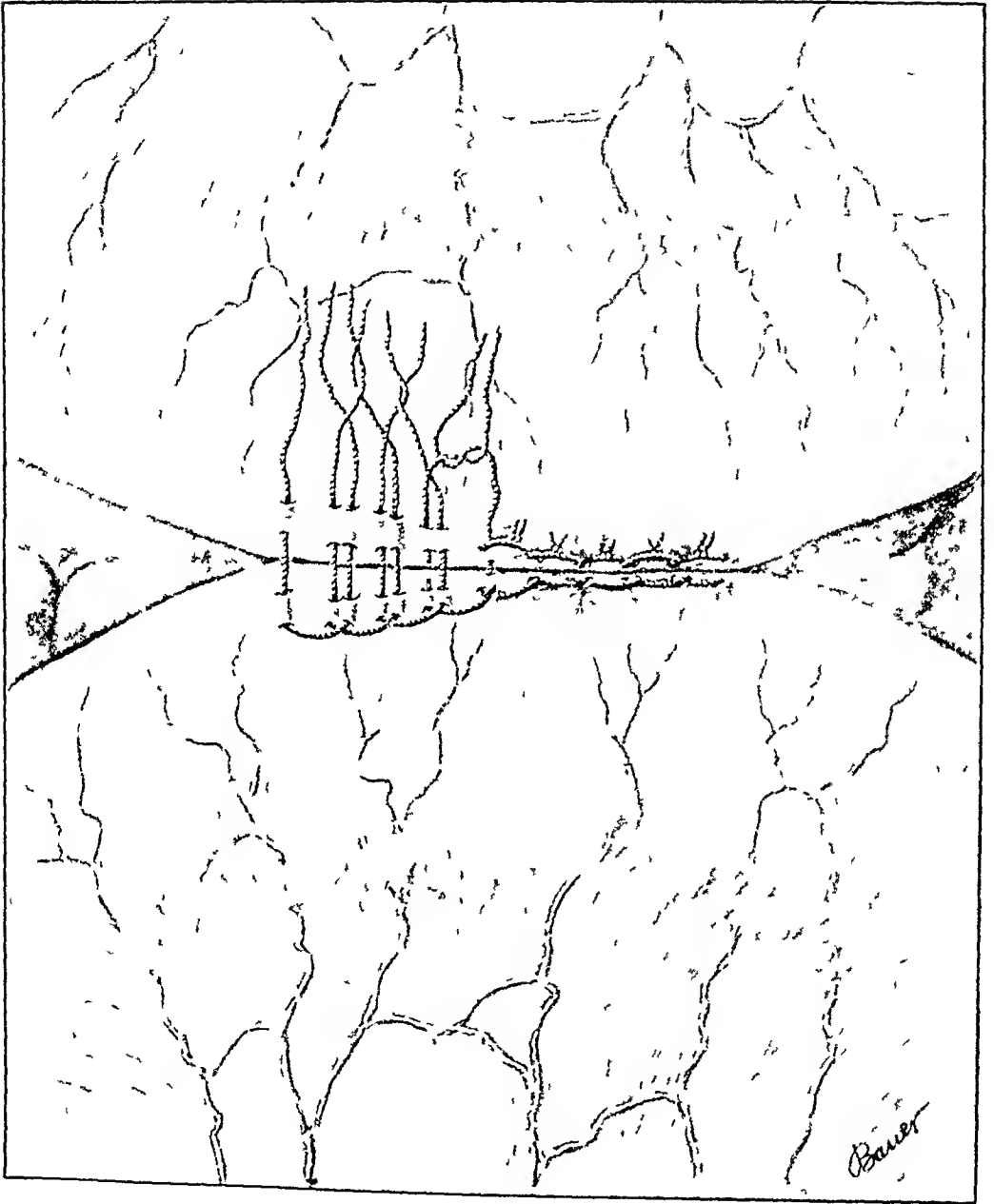


Closure with interlocking sutures Alternating knots This suture is simple and easy of insertion if it is remembered that all loose ends pass under the loops The knots are purposely shown loosely tied, to more fully illustrate the interlocking chain arrangement



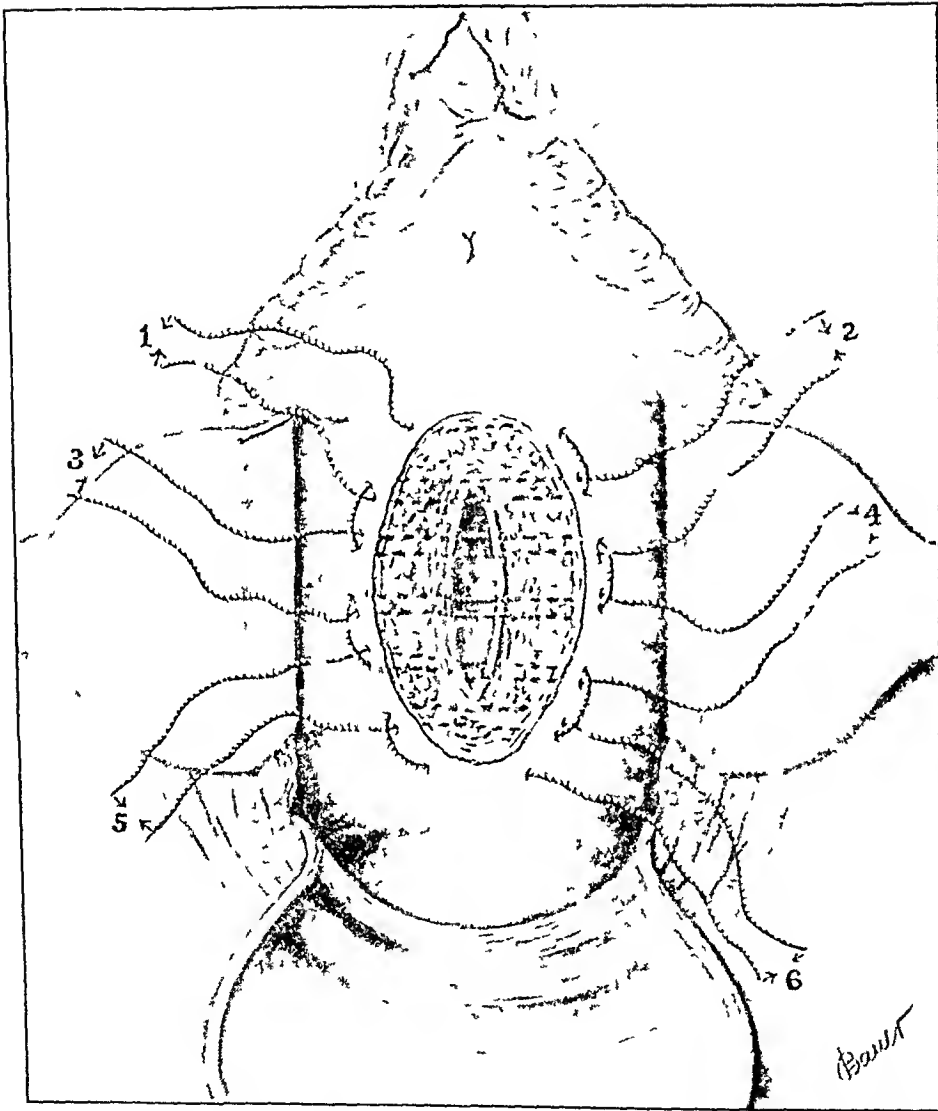
Halsted mattress sutures. Illustrating the manner in which spaces between sutures are increased upon tying the knots. This feature is exaggerated in the drawing to more fully bring out the weak points.

FIG 3



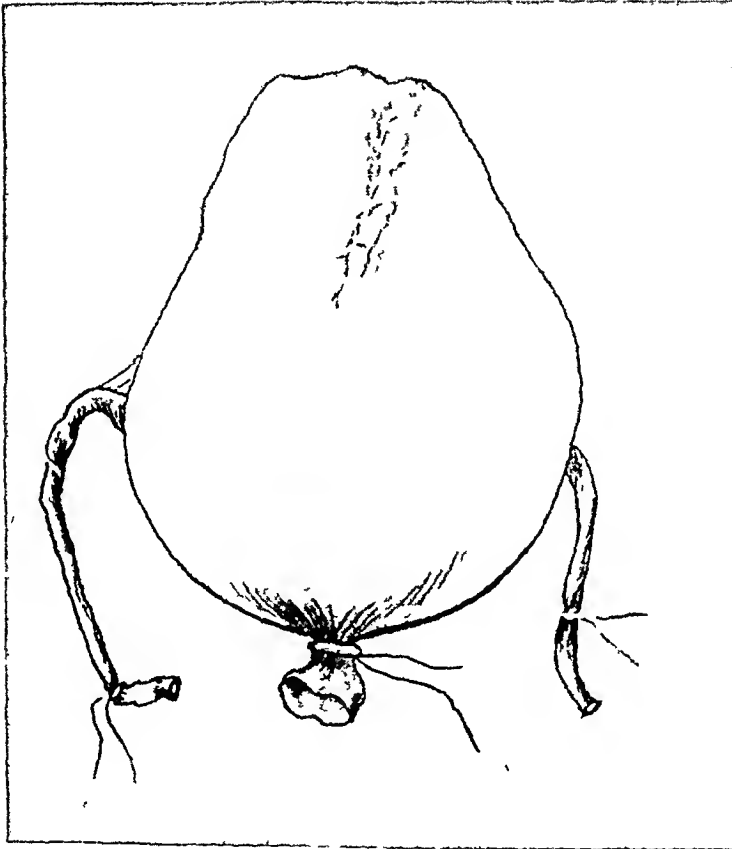
Interlocking suture with all knots on one side Showing manner of insertion of loops, and crossing of loose ends to form the chain

FIG 1

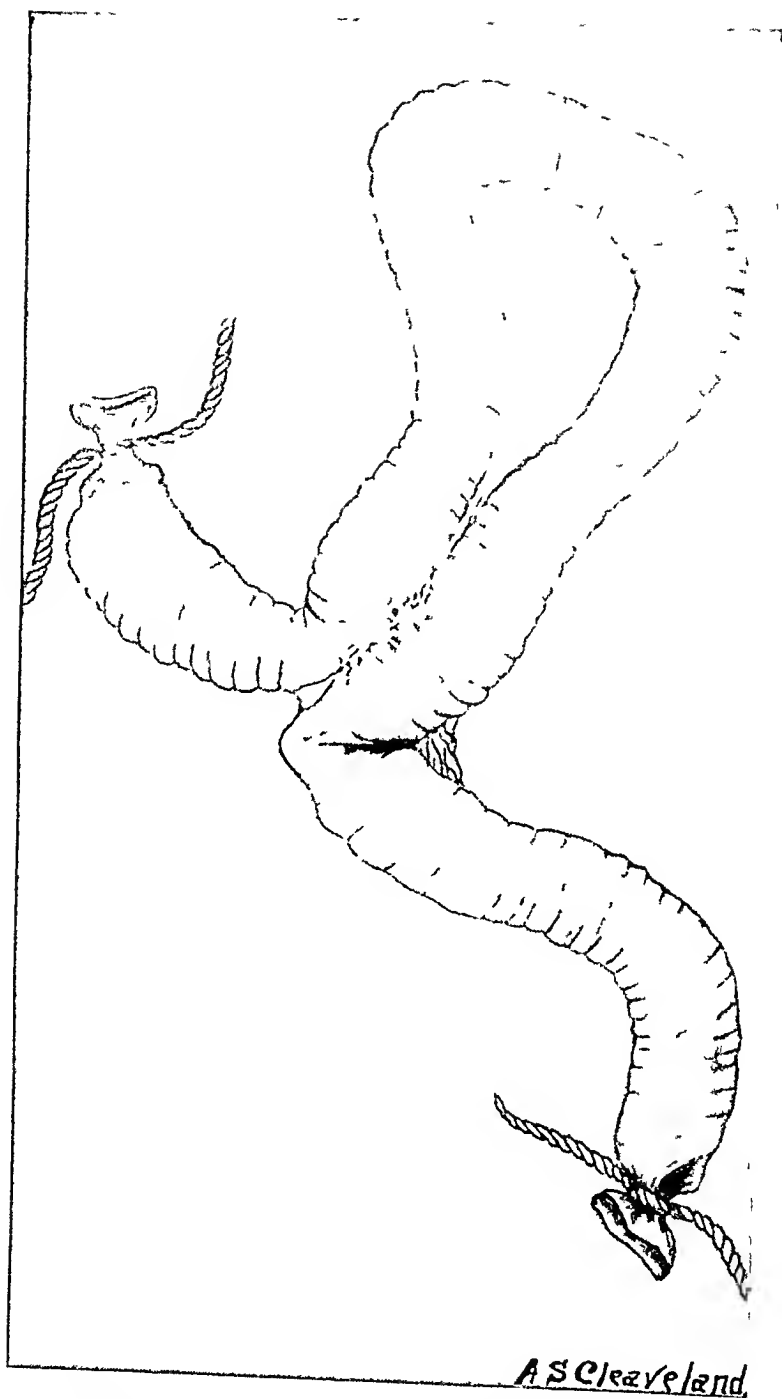


Closure of vesicovaginal fistula showing the interlocking suture inserted as in surface wound suturing in such a manner as to approximate the raw edges without inversion

FIG 5.



Bladder of dog Four weeks after resection and suture with interlocking stitch



Bowel of dog After lateral anastomosis with interlocking suture

interrupted interlocking feature, the completed chain is obviously stronger than any other form of interrupted or continuous suture, each stitch supporting and being supported by its neighbors. While the interlocking suture is perhaps not as easily and rapidly placed as other forms of interrupted stitch, yet there is but little difference since one interlocked suture covers the ground of about three Lemberts, or one and one-half Halsteds. It is not possible to properly form the chain of stitches if each is tied as soon as taken. The first and second sutures are inserted, the first is then tied, the third inserted while the second is loose, the second then tied, the fourth inserted, the third tied, and so on, always tying one stitch behind.

The interlocking stitch may be applied as in ordinary surface wound suturing, without the Lambert inversion of cut edges, so that when the sutures are tied the cut edges will be approximated. Figure 4 is illustrative of this method of wound closure.

In an extended series of experiments upon dogs, in which operations were performed on stomach, pylorus, small intestine, colon, and rectum, in no instance did we find post-mortem or secondary operative evidence of leakage, and in no case did we find sloughing from suture pressure. I note three deaths from peritonitis in a series of 100, in none of which was leakage recorded, post-mortem evidence showing the peritonitis to be general and probably due to faulty technic and infection during the operation.

Twenty-five operations upon the bladders of dogs, varying from simple incision and closure with the interlocking suture, to removal of two-thirds of the viscus, showed no leakage and no deaths.

A series of experiments upon blood vessels with interlocking sutures of fine silk was begun, but unfortunately not completed owing to the writer's removal from Chicago. The results obtained, while not complete nor extensive enough for definite conclusions, were very promising and indicated that

interlocking sutures may have a place in venous and arterial surgery

The suture, while not necessary in a majority of alimentary tract operations, is peculiarly applicable to those conditions in which post-operative suture leakage is to be utterly eliminated, such as in certain operations upon cæcum, colon, and rectum. It is also of value in operations upon gall-bladder, ducts, urinary bladder, and blood-vessels.

The following cases of the writer are reported as illustrative of the range of applicability of this stitch.

CASE I — *Suture of the Hepatic Duct After Removal of Large Stone* — This case was reported in detail in *ANNALS OF SURGERY* for April, 1903.

Two stones were removed from an enlarged, elongated and distended gall-bladder, one from the cystic duct, and a non-faceted stone, weighing 250 grains, measuring one and three-fourths inches in length and three and one-fourth inches in circumference, was removed from the hepatic duct through an anterior longitudinal duct incision.

The liver was retracted upward, the stomach and duodenum were retracted downward and to the left, tension sutures were placed at each end of the hepatic duct incision, and the opening in the duct closed by the interlocking suture (with knots alternating). Drainage was established through the resected gall-bladder.

This case demonstrates that by proper visceral retraction and packing off, and by use of traction sutures to immobilize the part to be closed, the interlocking stitch may readily be properly inserted in any locality accessible to any form of interrupted or continuous suture.

CASE II — *Suture of Bladder* — Mr. B, age 38. Left bubonocoele, large, right, partly strangulated and inflamed scrotal hernia.

The bubonocoele on the left side was closed by the Ferguson anatomic method without incident. On the right side the usual skin incision was made, the aponeurosis of the external oblique recognized and split upward to fully expose the sac and canal. Sac appeared hypertrophied and in a high state of congestion and inflammation. In attempting to isolate and open the sac a gush of fluid, easily recognized as urine, showed that the bladder had been inadvertently opened. In freeing the bladder a partial pro-

lapse of that viscus was demonstrated. The opening in the bladder was closed by one row of interrupted interlocking sutures (alternating knots) without Lembert inversion of edges. The sac was freed, and split up to the internal ring. The contained bowel and omentum, while highly congested, were not gangrenous, and were replaced in the abdominal cavity. The sac was removed and the operation completed as usual by the method of Ferguson. A few strands of silkworm gut were inserted as a drainage insurance.

Both wounds healed without incident, except for a slight superficial skin infection on right side. Drainage did not prove necessary. There was no urinary leakage, nor cystitis, nor at any time clinical indication that the bladder had been tampered with or irritated.

CASE III—*Suture of Axillary Vein*—Mrs S., age 47. Operated in 1903 for extensive carcinoma of left breast, with marked involvement of glands in the axilla and in the subclavian triangle. A typical Halsted amputation was done,—the axillary space, the subclavian triangle, the space between them and beneath the clavicle were thoroughly cleared. Several enlarged axillary glands were attached to the axillary vein so closely as to necessitate sharp dissection. All were removed, however, without injury to the vein, except one near the clavicle. In removing this gland, a slightly ragged lateral hole was cut or torn in the vein, equal in length to a little more than one-third the circumference of the vein. Because of the high location of the tear, I wished to avoid ligation if possible.

A purse-string suture of fine silk was inserted, cut edges of vein inverted, and the suture tightened. This, however, so reduced the calibre of the vessel that the procedure seemed unwise; the purse-string, therefore, was removed and the opening in the vein closed by one row of interrupted interlocking sutures of fine silk. Lembert inversion (alternating knots). Upon relieving compression and allowing the blood-current to flow through the vein, no leakage was discernible, and no additional reinforcing sutures were necessary.

The skin incisions were closed as usual, and the patient was constantly watched for a period of three weeks. There were at no time symptoms of leakage from the sutured vein, nor more than the usual amount of drainage.

There was no œdema of the arm, no circulatory disturbance, and no venous congestion. The patient recovered without untoward symptoms, death occurring fourteen months later from local recurrence of the cancer, with general metastasis.

CASE IV—*Typhoid Ulcer*—Mr R, age 32. Uneventful mild typhoid course for two weeks, when two slight hemorrhages occurred. In the early morning (4 A M) following he had a sudden sharp abdominal pain, seemingly more or less diffuse. After this subsided the patient remained fairly comfortable except for an occasional nausea and very moderate vomiting. The pulse and temperature rose during the forenoon and afternoon, the abdomen became tympanitic, with marked tenderness in the right lower quadrant. There were no symptoms of collapse. Blood count two days previously showed total leucocytes 6400, neutrophils 76 per cent, small mononuclears 12 per cent, large mononuclears and transitionals 10 per cent, neutrophilic myelocytes 2 per cent. At 6 P M the day of the pain the total leucocytes were 18,200, neutrophils 88 per cent, small mononuclears 4 per cent, large mononuclears and transitionals 8 per cent. Diagnosis was made of perforating ulcer, and operation performed fourteen hours after the attack of acute pain. An incision was made through the right rectus. A perforation was found in the ileum, approximately eleven inches from the ileocæcal valve. The opening was closed with one row of interrupted interlocking sutures of chromic gut (knots all on one side). No attempt was made to sponge more than the immediate vicinity of the ulcer. No irrigation or flushing was attempted, drainage was inserted, and the wound closed as rapidly as possible. The patient was placed in the Fowler position, and proctoclysis (Murphy) instituted. Reaction was prompt, the peritonitis did not become severe, and the patient recovered nicely from the immediate operation, later going to full recovery from the typhoid.

The blood findings in this case are pertinent, first, as regards prognosis. The prompt rise in neutrophilic cells showed that systemic reaction, and resistance to the peritoneal infection were active and strong, and hence lent a favorable aspect to the case, second, in view of the sudden neutrophilic hyperleucocytosis following the sharp abdominal pains, with rise of pulse, temperature and tympany, the diagnosis could scarcely be mistaken.

CASE V—*Suprapubic Cystotomy and Permeal Section*—Mr

Y., age 47. A median perineal section was made for the removal of a large imbedded vesical calculus. The stone was loosened, crushed, and removed piecemeal through the perineal incision. The vesical mucosa was the seat of a papillomatous growth, and fearing malignancy a suprapubic incision was made and the bladder opened extraperitoneally. Removal of the growth and sharp curettage showing no apparent involvement of the vesical muscularis, the upper opening in the bladder was closed by one row of interlocking sutures without Lembert inversion, and drainage established *via* perineum.

The patient ran the usual course of convalescence without symptoms of note, eventually recovering with but slight chronic cystitis. Suprapubic wounds healed kindly. No leakage.

CASE VI.—*Suprapubic Cystotomy*—Mr P., age 29. This patient had a vesical calculus, with apparently but a moderate cystitis. A suprapubic incision was made and the bladder opened extraperitoneally. The stone was removed, the vesical mucosa swabbed with a solution of nitrate of silver, thoroughly irrigated with hot boric solution, and because of the apparently good condition of the mucosa the bladder was closed with one row of interrupted interlocking sutures of formaldehyde gut (without Lembert inversion) without vesical drainage.

After operation the bladder was irrigated daily. The patient's immediate recovery was excellent. There was no sign of leakage, nor wound infection. While this case is illustrative of the prevention of leakage by the interlocking suture, yet an error was made in not establishing drainage, as is shown by the fact that cystitis persisted until I lost track of the case, a year later.

CASE VII.—*Fecal Fistula*—Mr Le M., age 42. First operation April, 1903, for appendiceal abscess. An incision was made well outward toward the anterior superior spine. Cæcum, ileum, and omentum were found to be a mass of agglutinated adhesions, with marked chronic inflammation and hypertrophy. Pus was deep and completely walled off. In clearing the adhesions to get down to the pus, a hole an inch in length was torn in the cæcum. This was closed by a continuous Cushing suture of catgut. The pus was evacuated, and a Mickulitz gauze-rubber tube drain inserted. Drainage was profuse, and fecal matter was detected in the dressings on the fourth day. Patient recovered rapidly with the sinus still discharging fæces. The fecal discharge continued

until August, when the sinus closed. It opened again a month later, and persisted with constant fecal discharge until March, 1904, when it again closed with symptoms of acute intestinal obstruction. It opened spontaneously on the second day of the attack, discharging an immense amount of feces. The patient then returned to me for second operation.

Second Operation, April, 1904—An elliptical incision about the fistulous opening was made down to the peritoneum, the peritoneum was opened circularly into the free cavity and the adherent mass of ileum, cæcum, and omentum, including the fistulous tract through abdominal wall, was lifted out of the wound. Adhesions were then broken down, the fistulous tract cut away, and the visceral adhesions cleared.

Two openings into bowel were found, one in the cæcum, at about the point of the tear in the first operation, the second at the ileocæcal junction, involving about three-quarters the circumference of the ileum. It being impossible to suture the lower opening, the ileum was cut completely away from the cæcum, and an anastomosis made with the Murphy button. The other opening in the cæcum was closed by one row of interrupted interlocking sutures of chromic gut (alternating knots), Lembert inversion of edges. The patient made a good recovery, other than a slight superficial infection, there was no leakage from the sutured bowel, the button passed on the tenth day, and patient walked out of the hospital at the end of the second week with the wound healed.

He was last seen in the fall of 1905 and at that time there had been no recurrence and no further trouble.

CASE VIII—*Vesicovaginal Fistula*—Woman, age 29. Vesicovaginal fistula following labor. Had had the fistula for four months, when she was operated upon in another city. So far as I was able to determine the usual beveled denudation was made and the fistulous opening closed by two rows (vesical and vaginal) of interrupted sutures. Leakage began again four days after operation, and continued until the case was referred to the writer.

Examination revealed a fistula nearly an inch in diameter, with a considerable amount of surrounding cicatricial tissue.

Operation under ether, Sims's position. The anterior vaginal wall was freed from the bladder, and the scar tissue removed. The opening in the bladder was carried into healthy tissue, beveled

towards the vesical mucosa, and closed by one row of interrupted interlocking sutures of chromic gut, not using the Lembert principle of inversion (knots alternating) The vaginal wall was closed by a suture of continuous chromic gut The patient made an uneventful recovery, with no leakage, and when heard from a year later, reported herself in excellent condition

CASE IX —*Suture of Rectum* —Mrs F, age 31, primipara, forceps delivery, complete perineal laceration through sphincter and upwards for nearly an inch and a half in rectal wall, immediate operation The tear in the rectum was closed by the interlocking stitch (chromic gut) from above downward, using the Lembert principle of inversion, without penetration of rectal mucosa All knots were on the vaginal side The sphincter was brought together by separate suture, and the perineum closed by the A Martin method

The wound healed kindly There was no deep infection of the wound, and no sign of leakage, nor infection from the rectal suturing A superficial infection caused some annoyance, but eventually cleared without necessitating further suturing The patient recovered with perfect rectal control and a sound perineum

PRIMARY SARCOMA OF THE PERITONEUM.

BY J M ELDER, M D,

OF MONTREAL, CANADA

THE paucity of surgical literature on the subject of primary sarcomatous tumors of the peritoneum and the interesting post-mortem findings regarding the questions of rapid tumor growth and metastases in the case which came to autopsy, justify me in publishing these two cases, both of which occurred in the Montreal General Hospital during the summer of 1907

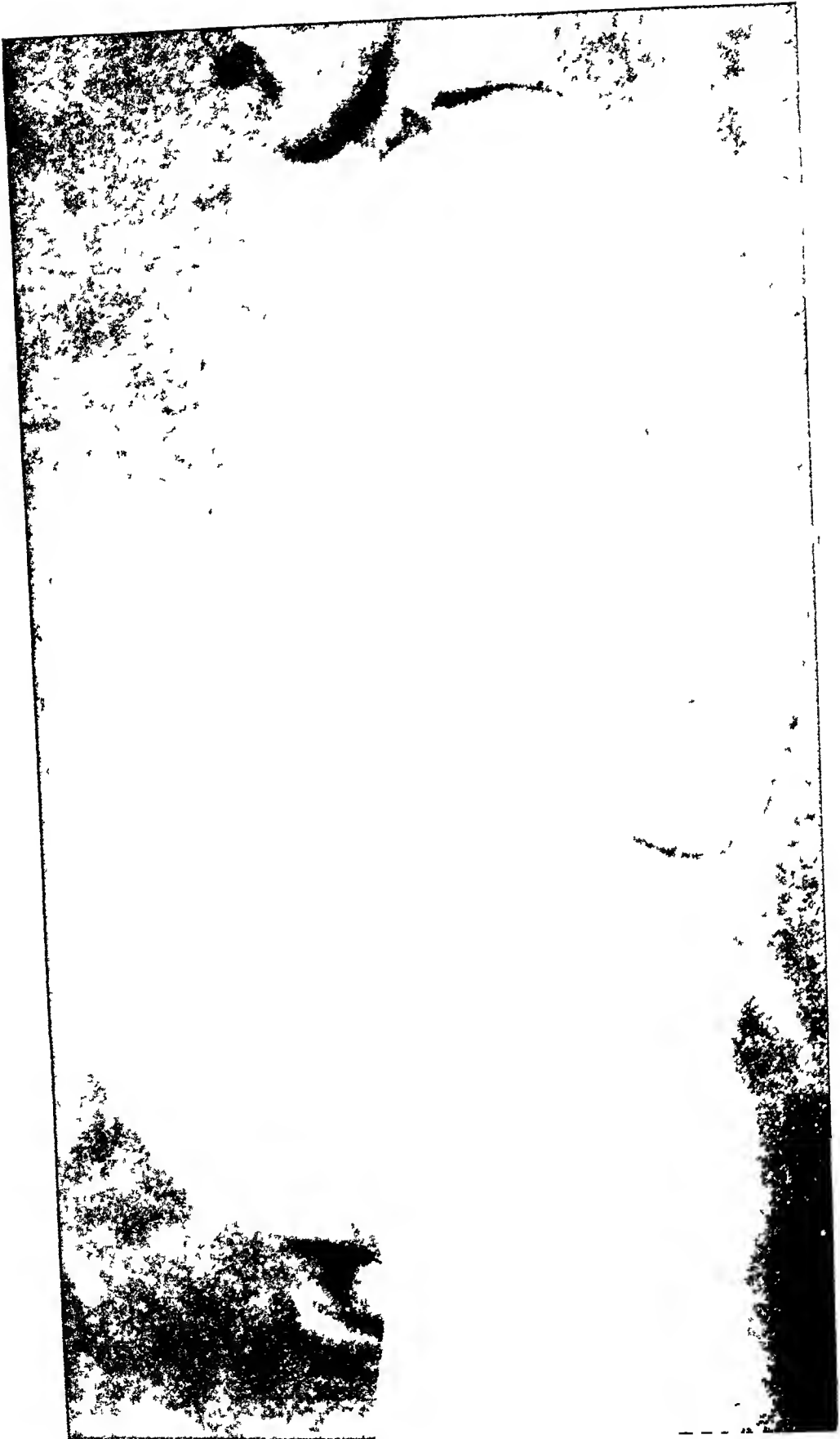
CASE I —(561 M, 862 S, 1907 M G H Reports) N M, sailor, aged 33, admitted to the service of Dr Lafleur, June 22, 1907, complaining of swelling of the abdomen. Family history good, personal history negative except that he has been a hard drinker since he was 15 years of age

Present illness —Began nine months ago, when he decided that he did not feel as strong as before and therefore secured employment ashore. Three months later he noticed swelling of the abdomen, but attributed his supposed corpulency to drink and easy work. This abdominal enlargement gradually increased but without producing distress to the patient until a truss, which he had worn for years, became too small. He vomited several times during the summer of 1906, chiefly his breakfast, but attributed this to too much beer the night before. He had no pain or swelling of the lower extremities. There was slight dyspnoea on exertion.

Present condition —Fairly well nourished man, of good musculature, with conjunctivæ slightly yellow. Expression anxious and malar bones slightly prominent. Weight 175 lbs. Temperature 99° and pulse 70.

On examination, thoracic organs fairly normal, but abdomen presented a peculiar condition. It was enormously distended, with marked bulging of the flanks and over the inguinal region (Fig 1). This distention is symmetrical, and abdominal walls move freely with respiration. The superficial epigastric veins

FIG 1



Showing general outlines of the abdominal distention

on either side are markedly distended and run up to anastomose with the mammary veins

On palpation, the walls are tense but there is no rigidity on deep pressure, except over the right upper quadrant where the resistance is definitely increased but no distinct mass can be felt; no tenderness, no fluctuation

Percussion shows a marked dull note all over the anterior aspect of the abdomen except the epigastrium and flanks, where note is tympanitic. These dull and tympanitic areas are not affected by change of posture. Liver dulness begins at sixth rib in nipple line and is continuous below with dulness noted above. No change in spleen could be made out. Urine normal except trace of bile pigment. On June 25 an exploring needle was introduced into the dull area below the umbilicus and only about 1 c c of bloody serum could be obtained. This fluid showed microscopically numerous large round cells, several spindle-cells and numerous blood-cells. The temperature runs from $99\frac{1}{2}^{\circ}$ to normal, and pulse about 90

[The above is an extract from Dr Lafleur's clinical notes of the case. At this stage the patient was transferred to the surgical ward for exploratory laparotomy.]

Extract from Surgical Notes—The following questions regarding the diagnosis suggested themselves to us for solution at the exploratory laparotomy: (1) diffuse tuberculous peritonitis, (2) cirrhosis of the liver, with ascites; (3) omental cysts (malignant?), (4) hyatid disease, and (5) mesenteric sarcoma

We were rather inclined to regard the trouble as tubercular, and on June 27, under ether narcosis, which caused marked cyanosis, an exploratory incision was made in the median line below the umbilicus. On opening the peritoneum several small gelatinous cysts popped out, some of which were sent to the pathologist for examination. There was no free fluid. The tumor was seen to be chiefly in the great omentum which was adherent to the parietal peritoneum. Upon tearing through the omentum the mesentery was also seen to be involved. The whole omentum was filled with these cyst-like bodies, which appeared to be caught in a very vascular stroma.

This condition extended up to and obscured a good view of the liver. So dilated were the omental veins that we were afraid that undue handling might cause hemorrhage.

The picture was one of sarcoma, rapidly growing, in the omentum and mesentery. A piece of diseased omentum was tied off and removed, for examination, and the abdomen closed without drainage. His recovery from operation was uneventful and the patient left the hospital on July 18 in much the same physical condition, except somewhat weaker, than when he came in. Unfortunately, as is usual with sailors, we lost all trace of him.

CASE II—(859 M, 1341 S, 1907, M G H Reports)—I am indebted to my medical colleague Dr. Finley for the clinical history of this case. W. R., aged 24, waiter, admitted to Ward H on September 18, 1907, complaining of pain in the abdomen, diarrhœa, cough, and pain in the right side of the chest. Associated with these symptoms were night sweats, anorexia, progressive loss of weight and strength, dyspnœa and hiccough. His mother died from some tubercular trouble when he was four years old. The patient had been previously fairly healthy and only uses alcohol moderately.

Present illness—Began eleven days prior to admission with severe diarrhœa, which has been fairly constant until two days ago when it became much worse, 9–15 stools per day. The feces are liquid and dark green in color. Patient began to cough six days before he came to hospital. Very little expectoration until last night, when he expectorated some "black stuff" which suggested blood. Coincident with the beginning of the cough he felt abdominal pain, at first slight but daily becoming more severe. These pains are now lancinating in character and require morphia to procure sleep. He states that he had an attack of colic two months ago which lasted for three hours and was very severe. There was no recurrence until present illness. Since January, 1907 he has lost 39 pounds in weight and has had night sweats since September 1.

On admission—Well-developed and fairly well-nourished man, with pale anxious face, covered with perspiration. No

anæmia of mucous membranes Assumes any position in bed
Temperature subnormal, pulse 96, respirations 24

Physical examination —(a) *Thorax* Dulness in both axillæ, otherwise resonant in front with normal breath sounds Behind, marked dulness on right side below level of fifth spine Absolutely flat note at base of right lung Over upper part of this area, tactile fremitus and breath sounds are impaired, while at lower part both are quite absent Ægophony at base On the left side there is dulness, with diminished respiratory sounds (b) *Abdomen* Symmetrically distended, rigid, and markedly tender over hypogastric region There is marked dulness everywhere, except over the stomach, and down as far as the umbilicus No fluctuation and no change in dull area by change in posture Digital rectal examination is negative Urine 1010, no casts, albumin or sugar

In spite of rest, diet and treatment, the diarrhoea persists On September 22 an aspirating needle was introduced into the right pleura and a large quantity of thin, purulent fluid removed, a smear of which shows numerous polynuclears but no organisms

Next day I saw the case with Dr Finley, and was struck with the similarity between it and the previous one The patient was transferred to my ward for thoracotomy and exploratory laparotomy, which were proceeded with immediately Upon opening the right pleural cavity posteriorly, about a quart of sero-sanguineous fluid gushed out Both layers of pleuræ were greatly thickened and studded with rather firm nodules varying in size from a split pea to a bean A tube was left in the thoracotomy wound through which considerable fluid continued to drain

The abdomen was next opened in the median line below the umbilicus In cutting through the abdominal wall numerous large veins were encountered, the operator remarking that they were suggestive of sarcoma In the peritoneal cavity was a large quantity of fluid, similar to that which had just been evacuated from the right pleural sac The parietal peritoneum was very thick, dark red in color, and studded with nodules similar to those in the pleura The great omentum was seen to be enormously thickened and studded with dark, purplish nodules A pathological examination of excised specimens showed a large round cell sarcoma.

The coils of intestine were much thickened and nodular, feeling like strands of rope, and were very adherent to one another. The mesenteric glands were very large and hard. The abdomen was hurriedly closed with through and through sutures, as the patient took the anæsthetic badly, and his pulse was very weak.

After operation the patient grew steadily worse, the temperature being mostly subnormal, and the pulse weak and rapid, until he died on the evening of the second day after operation.

EXCERPTS FROM AUTOPSY RECORD OF W. R. WITH PARTICULAR
RELEVANCY TO THE DEGREE AND CHARACTER OF MAIN TUMOR
AND ITS METASTASES (SERVICE OF DR. ELDER)

Peritoneal Cavity—Upon opening the abdomen a moderate amount of salmon-colored, turbid, watery pus flows out. The omentum is large and covers the whole of the intestines, being wrapped into both loins and extending into the pelvis. It is much thickened in places, measuring about 1.5 cm in thickness, this is due to numerous small nodules of soft, friable, greyish-pink material, some being distinct and others confluent. On section these nodules are homogeneous in appearance and soft. The borders of the omentum are especially filled with this tissue. The vessels are dilated. There are several dilated veins extending from the omentum across the transverse colon and gastrocolic omentum to the lower border of the stomach. The parietal peritoneum, in the neighborhood of the spleen, is thickened to about 1 cm, moderately firm, but friable. On section, this thickening is seen to be due to infiltration with a tumor mass similar to that found in the omentum. The parietal peritoneum in the pelvis, especially that lying between the bladder and rectum, is similarly infiltrated. The *Mesenteric Lymph Nodes* are enlarged, the largest being about the size of pigeons' eggs. The whole mesentery, too, is thickened to about 1 cm. The surface of the mesentery contains purplish blotches. On section the enlarged glands and mesenteric tissue are seen to consist almost entirely of homogeneous, greyish-pink, soft, moderately friable tissue similar to that seen elsewhere. In certain areas there is definite evidence of a hemorrhagic condition. Covering the whole of the large bowel and looking like large appendices epiploicæ are numerous areas measuring from 2 to

4 cm in length, made up of similar tissue to that described above, some on section are very hemorrhagic. In places the tumor has infiltrated the intestinal wall. There is an area in the ileum about 60 cm from the ileocæcal valve which is completely infiltrated by the tumor. This surface appears nodular and mottled. Upon opening, the mucosa shows a small area 3 by 2 cm of tissue denuded of mucosa, hyperæmic in appearance, though smooth. The intestinal wall is about 1 cm in thickness.

The glands about the lesser curvature of the stomach and the head of the pancreas are markedly enlarged. The retroperitoneal and pelvic glands are enlarged and soft. There are numerous polyp1 of tumor tissue upon the under surface of the liver and over the spleen. The *Appendix* is very much thickened, measuring 8 cm in length and 2 cm in thickness. The meso-appendix is similarly involved. *Diaphragm* left fifth space, right fourth space.

Pleural Cavities—The right cavity contains a small amount of pus. The parietal and visceral pleuræ are covered with a thick, yellowish, plastic exudate. The pleura is injected. The diaphragm is thickened, being mottled in appearance and infiltrated with new growth. It measures 1.2 cm in thickness. The upper surface contains numerous heaped up masses of similar tumor tissue. The left pleura shows a profuse covering of both parietal and visceral pleuræ, with raised, flattened discs of tumor mass. The diaphragm is involved in a manner similar to that on the right side.

Pericardial Cavity—Between the pericardium and the sternum there are masses of tumor. The heart shows on its anterior aspect numerous small areas of whitish thickened epicardium. There is a normal amount of straw colored fluid.

Spleen—Also shows two or three small areas of tumor tissue on the upper surface. On section the spleen is pale. The Malpighian bodies are large and numerous. An increased amount of pulp comes away on scraping.

Pancreas—Normal in color and consistence, covered with tumor-glands and thickened peritoneum.

The thoracic duct, especially in the abdomen, together with the lymphatics leading into it, is thickened and its lumen is obliterated by tumor tissue.

Liver—Weight, 2045 Gm. Normal in consistence, some-

what pale in color and soft. The upper surface is adherent to the diaphragm and infiltrated by tumors. Along the outer border and outer surface of the left lobe are numerous tags of pale yellowish-pink, very soft tissue adherent to the peritoneum but easily brushed off. On section the liver is pale, with lobules indistinct, and friable.

Kidneys—Normal except that in the kidney substance there are several small nodules measuring 3 mm in diameter, of greyish, moderately firm, semi-translucent tissue.

Anatomical Diagnosis—General sarcomatosis of the omentum, glands of the mesentery, retroperitoneal and pelvic glands, bronchial glands, peritoneum, large and small intestines, diaphragm and pleurae, pancreas and thoracic duct. Acute diffiuent peritonitis. Acute pleuritis with empyema. Septicæmia (streptococcic infection). Ascites. Fatty liver. Perihepatitis. Perisplenitis.

MICROSCOPICAL EXAMINATION

Omentum—The omental tissue is everywhere infiltrated with small round cells with large spherical nuclei which are granular in appearance, the cells having but little protoplasm. Large numbers of these cells are in mytosis. There is very little intercellular substance, only here and there do the cellular masses present connective tissue trabeculae. In some of the less dense areas there still remain isolated clusters of omental fat as indicated by large spaces. In areas that are only sparsely invaded the above described cells follow along in irregular columns between the fat cells. In places there are areas which show enormous vascularity, many vessels are new. At one side of the section there is considerable fibrous tissue and smooth muscle. The muscle is everywhere infiltrated with the above described lymphoid cells. In what appears to be the zone between the muscle and the fat tissue is a fairly dense layer of fibrin.

Intestine—The mucosa over part of the section is absent, the exposed submucosa is covered with a layer of necrotic cells as evidenced by their taking the red stain and showing no nuclei. The submucosa and the muscle layer are infiltrated by large numbers of cells similar to those described above in the omentum. The normal appearance of the submucosa and muscularis is completely lost, here and there are isolated islands of circular muscle and often in the same field similar islands of

longitudinal muscle The submucosa is densely packed with tumor cells, more so than any other layer of the gut There is also a band of similar cells lying beneath the serosa and between it and the outer muscle layer Upon the surface of the serosa there is a collection of loose tissue made up of similar cells and a small amount of fibrous tissue, apparently this condition is due to the infiltration of old adhesions

Diaphragm —The muscle fibres present are for the most part cut longitudinally, striations are well marked The individual fibres are widely separated by masses of tumor cells which extend in long solid columns between the muscle fibres These cells make up the greater part of the section At the edges of the section the tumor elements are more densely aggregated than those that have infiltrated the muscle

Pancreas —The alveolar tissue about the organ is composed almost entirely of tumor cells In places these project down into the substance of the pancreas, for the most part following the trabeculæ, though there are places where they break through the connective tissue capsule of the lobes and scatter all through the acini

[For the foregoing report, the author wishes to thank Dr C W Duval, the hospital pathologist, and Dr F D Gurd, his assistant]

As was hinted in the beginning of this paper, I was astonished in looking through such surgical works of reference as were at my command, to find so little written upon this subject Most writers do not mention the subject at all, while others say that while the condition might occur it must be extremely rare In Sajous' "Analytical Cyclopædia of Practical Medicine" (1901), vol v, p 436, I found the best reference "Sarcoma of the mesentery is of rapid growth and almost always ends fatally. Ascites is usually present There is rapid involvement of surrounding structures, making removal impossible" A review of the literature from 1896 to 1900 follows, which shows that out of 57 cases of solid tumors of the mesentery reported, 11 were sarcoma One case, that of a physician, is reported, in which a diagnosis of cirrhotic liver was made, based upon ascites and inability to

palpate the liver or outline it by percussion. Necropsy showed a tumor involving the mesentery and adjacent glands, with numerous metastases in the pancreas, greater and lesser omentum, pleura, bronchial and inguinal glands. Microscopically it proved to be lymphosarcoma of the mesentery.

The clinical pictures presented by our two cases varied considerably, as a reference to the histories will show. Yet both suggested tubercular peritonitis in some of its varied forms. The second case was particularly suggestive of rapid, miliary tuberculosis of the serous sacs (peritoneum and pleuræ), while Case I rather pointed to the chronic form of tubercular disease of the peritoneum, where there is present great thickening of the omentum with little or no fluid. It is greatly to be questioned if some cases, at least, of peritonitis attributed to tubercular infection, and in which no exploratory operation or post-mortem examination has been made, may not have been really cases of sarcoma of the peritoneum.

I do not think that clinically we are yet in a position to make other than a tentative diagnosis in these cases, which diagnosis must be confirmed either by post-mortem findings or ante-mortem specimens subjected to microscopical examination.

GUNSHOT WOUND OF ABDOMEN INVOLVING THE STOMACH AND JEJUNUM, COMPLICATED WITH PREGNANCY.

BY H M LEE, M.D.,
OF NEW LONDON, CONN

CASE RECORD—White, female, 23 years of age, married, mother of one child, housewife by occupation. Was admitted to the hospital in the forenoon of January 26, 1907, with a gunshot wound in epigastrium, $\frac{1}{2}$ inch from middle line on right side and $2\frac{1}{2}$ inches downward from the ensiform cartilage, and gunshot wound in right hand between the second and third metacarpal bones. On admission, pulse, 120, temperature, 100° , respiration, 28.

History of Present Illness—While standing in her room with a child in her arms, she was shot and wounded as above described, at 6 00 P M, the day before admission to the hospital.

Examination at the time revealed a bullet wound penetrating the abdominal cavity in a direction slightly upwards and towards the right. From the wound a serous fluid and gas escaped on pressure being applied. The abdomen distended markedly, with evidence of gas in the abdominal cavity. The uterus was enlarged and the patient seven months pregnant. Placental bruit and foetal heart distinctly heard. The quickened respiration, rapid pulse, tenderness, rigidity and pain over the entire abdomen, the temperature and facial aspect determined accurately that a sharp peritonitis was in progress, and an immediate operation was undertaken under ether anæsthesia. An incision was made into the abdomen, just to the right of the midline, extending from a point a little below the ensiform cartilage downward to the umbilicus.

Upon opening the abdominal cavity, the parietal peritoneum in the region of the wound and the visceral peritoneum were injected and covered here and there with pus. In the anterior wall of the stomach, $\frac{1}{2}$ inch above the inferior border, was a large ragged opening extending through all the coats of the stomach, 3 inches long, running upwards toward the pylorus. The mucous membrane on the posterior surface opposite this wound, and in a space covering almost the entire pyloric area, was injected, and

at the centre of this injected area, a large mass of contused tissue appeared. The stomach contents, pus, serum and blood, filled the cavity of the abdomen. At a point in the jejunum, about 14 inches from the fossæ of Treitz, were three punctured wounds, irregular and ragged in outline, penetrating the coats of the gut. Two were in the anterior aspect of the gut, 1 inch apart, and the third in apparently another coil at the upper border of the gut 14 inches lower down the tract. This coil of intestines was glued together by adhesions and much pus and intestinal contents noted in and around the points of injury, and on every hand evidence of peritonitis.

Procedure—The detritus found in the cavity was washed out by saline solution—the intestines thoroughly washed and searched for injury. The wound in the stomach was treated by a free incision well beyond the bruised area, in order to get healthy tissue to approximate, and the wound united by continuous sutures through the muscular and submucous coats, a layer of Czerny-Lembert sutures, reinforced by Halsted's sutures, completed the union of the rest of the wound. The wounds in the gut were closed by Lembert sutures.

The contused area spoken of in the posterior wall of the stomach was cleared away by cutting out mucous membrane and part of the muscle wall of the stomach and the edges brought together by continuous submucous sutures. The patient was but a short time under the ether and stood the operation well. Intravenous saline 1000 c c given during the operation and a large amount of saline solution was left in the cavity. The bullet was not found. The incision was closed in layer, with a cigarette drain down to wound in stomach.

The patient made an uneventful recovery. The only treatment being thirty-six hours of slow rectal irrigations and morphia, to prevent possible uterine contractions.

The patient left the hospital on February 15. Came back two weeks later to arrange for her delivery there and was then well. Was in due time delivered of a healthy child and to-day is as well as ever.

APPENDICITIS AND TETANY.

BY CHARLES H. GOODRICH, M D,

OF BROOKLYN, N Y,

Attending Surgeon to the Methodist Episcopal Hospital and to the
Brooklyn Orphan Asylum

ON Tuesday, June 23, 1908, a young woman, 19 years old, was referred to my service at the Methodist Episcopal Hospital by her physician, Dr E J Kenny. She had been in excellent health until the midnight immediately preceding her admission. During the evening she had devoured a vicious mixture of foods including clams, soft shell crabs, ice-cream, and peanuts. She retired about eleven o'clock and one hour later was seized with violent pain in the right iliac region which rapidly extended over the entire lower abdomen. Vomiting was repeated several times during the night, affording no relief for the pain. Dr Kenny saw her in the early morning, administered a mixture containing one grain of opium and ordered an enema which was effectual. When he saw her at 1 P M he made the diagnosis of acute appendicitis from tenderness over the right iliac region (not definitely localized), the temperature 102° F and the pulse 92. He referred her to me as a very acute case and the ambulance was dispatched for her promptly. Upon the arrival of the ambulance surgeon at 2 15 P M she complained of pains in her hands and feet, and her thumbs were tonically opposed to the palms. Any passive motion of thumbs was accompanied by great pain. The slightly extended feet were exquisitely sensitive on flexion. The jolting of the ambulance gave her great pain in the extremities which attracted her attention at this time more than any abdominal discomfort. Upon her arrival at the hospital she was examined by the House-Surgeon, Dr F P Keil, who at once made a diagnosis of gastro-intestinal tetany, reporting this and a leucocyte count of 23,250, with 78 per cent polymorphonuclear leucocytes at 3 P M. I saw the patient at 3 30 P M when she presented the typical picture of gastro-intestinal tetany. Her temperature had risen to 103 4°, pulse 98. The chest was negative. The abdomen was generally tender over its lower half, with somewhat exaggerated tenderness

over the centre of the right iliac region I found the right rectus very slightly rigid, although this opinion was dissented from by Drs Keil and Kenny and my assistant, Dr Durham

As abdominal pain and tenderness are usual in gastro-intestinal tetany, and as the typical signs of appendicitis were not especially marked it became a question whether or not abdominal section should be undertaken The leucocytosis was cited as a reason for exploration Thereupon it was recalled that such a blood phenomenon might be possible with gastro-intestinal toxæmia so profound as to cause tetany, although the literature has thus far been silent on this point

The abdomen was opened through the right rectus incision The examining finger found a thickened appendix hanging over the pelvic brim After enlarging the peritoneal incision it was delivered,—distorted, greenish, succulent from base to tip It was typically removed, the base being cauterized with carbolic acid and inverted through a purse-string of catgut The stump of the meso-appendix was sutured as a fortifying pad over the remaining dimple, the suture being introduced distally to the ligature previously applied to the meso-appendix This method long ago suggested and for some years practised by the writer, not only strengthens the intestinal wall and inverts the raw, cut surface of the meso-appendix, but also avoids the possibility of traction releasing the original ligature One case of secondary hemorrhage has come under our observation where the suture and the meso-appendix ligature were tied together after the manner largely used

Upon cross section the appendix was found to have gangrenous mucosa, and necrosing muscularis and serosa It was filled with liquid fæces and pus

The microscopic picture as reported by Dr Dexter, Pathologist, is as follows "Round cells of inflammation, isolated and partly broken down connective-tissue cells, adipose, and blood cells are in various stages of disintegration Portions of blood-vessel walls and much detritus can be made out Relations of the various tunics of the appendix and relations of the morphological elements to one another are almost entirely destroyed"

The patient has made an uneventful recovery, the temperature touching normal on the day following that of operation

The wound healed per primam The symptoms of tetany gradually disappeared during the night succeeding the day of operation and did not recur. As no effort to evacuate her bowels was made until the third day, the presumption that the destructive inflammation of the appendix caused the symptoms of tetany seems reasonable.

HARRINGTON'S OPERATION OF INTRAPERITONEAL CYSTOTOMY,

WITH REPORT OF FOUR CASES

BY CHARLES L. SCUDDER, M.D.,

OF BOSTON, MASS.,

Surgeon to the Massachusetts General Hospital, Lecturer on Surgery
Harvard University Medical School

AND

LINCOLN DAVIS, M.D.,

OF BOSTON, MASS.,

Surgeon to Out Patients at the Massachusetts General Hospital

ON June 10, 1893, before the Obstetrical Society of Boston, Mass., Dr. F. B. Harrington read a paper entitled "On the Feasibility of Intraperitoneal Cystotomy, with the report of a case." This paper was subsequently printed in the ANNALS OF SURGERY in October, 1893,—fifteen years ago.

Harrington in this paper states that after "repeated trials upon the cadaver it has been found that the bladder may be sewed up intraabdominally so that it resists much distention both by water and air." Harrington cites the accidental incision of the bladder during laparotomy with subsequent safe suturing, the successful treatment by suture of the bladder for penetrating wounds, the safe suture of the stomach, gall-bladder, and intestine. He then asks very pertinently, "why then should the bladder not be approached by the route which affords the greatest facilities?" Harrington further says, "with proper care it is probable that the bladder can be as certainly shut off as the stomach or intestines. The flow of urine through the ureters is, as a rule, by drops, and can be easily taken care of by an assistant with sponges."

Again, "intraperitoneal cystotomy may be performed for tumors of the bladder, for enlarged prostate, for disease of the ureters, for cases of stone in the bladder of great size, and for sacculated stone. There are advantages in the operation which

certainly, at times, render it preferable to suprapubic cystotomy" Harrington then describes the steps of the operation in great detail,—the walling off of the intestine, the opening of the bladder, the control of hemorrhage within the bladder, the closure of the bladder wound, the complete closure of the abdominal wound. He then says, "the intraperitoneal operation does not interfere with suprapubic drainage, should drainage be necessary. As a rule, however, drainage will not be necessary, except that which can be obtained by the urethra."

Then follows the report of an intractable case of hemorrhagic cystitis for which much had been attempted with little success. Harrington decided that by means of an intraperitoneal cystotomy he could inspect and treat the interior of the bladder most advantageously. He operated by this method, curetted certain areas of the bladder mucosa, excised other areas to sound tissue, closed the bladder tight by suture, closed the abdominal wound tight by suture and drained the bladder. The subsequent history shows that the woman was practically cured of her difficulty.

The conception of the operation of intraperitoneal cystotomy, the experimental work upon the cadaver to place the operation upon a sound physical basis, the demonstration upon man that it is a safe and satisfactory procedure, the advocacy in 1893 of this operation in the *ANNALS OF SURGERY* as a new and tried operative procedure, subsequent operations for tumor of the bladder done by Harrington as yet unpublished,—these facts establish intraperitoneal cystotomy as a definite and original surgical operation. This has been the work of Harrington. The procedure, for whatever cause undertaken, should very properly be known as Harrington's operation of intraperitoneal cystotomy. We have been unable with the literature at our disposal,—and a careful search has been made,—to discover any similar systematic and constructive work done at an earlier time by any other surgeon. The recent report of Dr. Charles Mayo in the *ANNALS OF SURGERY* for July, 1908, serves as valuable independent evidence in favor of this established operation of Harrington.

The writers, working in the same surgical clinic with Harrington, wish to report here four cases of intraperitoneal cystotomy. They are indebted to Dr. Harrington for suggestions and encouragement in connection with these cases.

CASE I—W. T. (No. 157,342), male, 42 years old, married, a glass packer, was admitted to the Massachusetts General Hospital on Dr. Mixter's service, on March 6, 1908, recommended by Dr. John E. Somers, of Cambridge, and was kindly transferred to the writer for treatment.

The family history and previous history are unimportant.

Six months ago first noticed that the urine was bloody. There was no pain at this time, and the blood soon disappeared. Six weeks ago the urine again became bloody, but cleared up in two days. Patient stayed in bed ten days, and then returned to work. Then began to have increasing frequency of micturition accompanied by pain, finally requiring catheterization twice daily.

Examination showed a well-developed and well-nourished man of striking pallor. Chest and abdomen negative. External genitalia normal. By rectum prostate felt to be symmetrically enlarged and very hard. Urine contained blood, with small amount of pus and bladder epithelium.

Cystoscopic examination of March 9, 1908, is recorded as follows: "Cystoscopy shows a partly villous and partly smooth rounded tumor, size of a small egg, intimately connected with prostate and hanging down from above the internal urethral orifice; its base cannot be seen. Floor of the bladder inflamed with a few small calcareous deposits. Ureteral openings normal. Cystoscopic diagnosis: tumor of bladder, probably malignant."

March 13. Operation (L. D.) Bladder washed out and filled with boric acid solution. Usual suprapubic cystotomy incision. A lobulated tumor arising from close to the internal urethral orifice could be felt. On account of the limitation of the cystotomy incision, it was difficult to make out the character and attachments of the tumor. The bladder was therefore dried and packed with gauze, and the abdominal wall incised upwards for about three inches, opening the peritoneal cavity, the intestines were walled off with a gauze pack, and the original cystotomy incision extended backwards in the median line for about two and one-half inches (Fig. 1). This gave a splendid approach to

FIG 1



Illustrating Harrington's intraperitoneal cystotomy for new growth of the urinary bladder. Note long abdominal incision well retracted with broad retractors, intestinal coils completely concealed and protected by gauze, low posterior incision into bladder held open with narrow retractors, an anterior retractor in the bladder is often helpful, internal meatus, ureteral orifices, tumor, traction suture, deep pelvic folds, large blood vessels, rectum.

FIG. 2



CASE I Semi-diagrammatic drawing of median section of pelvis showing cystic prostate with reconstruction of bladder tumor arising by a pedicle from within the prostatic urethra

the tumor, and it was then seen to be pedunculated with the pedicle actually arising from within the prostatic urethra (Fig 2). The

FIG 3

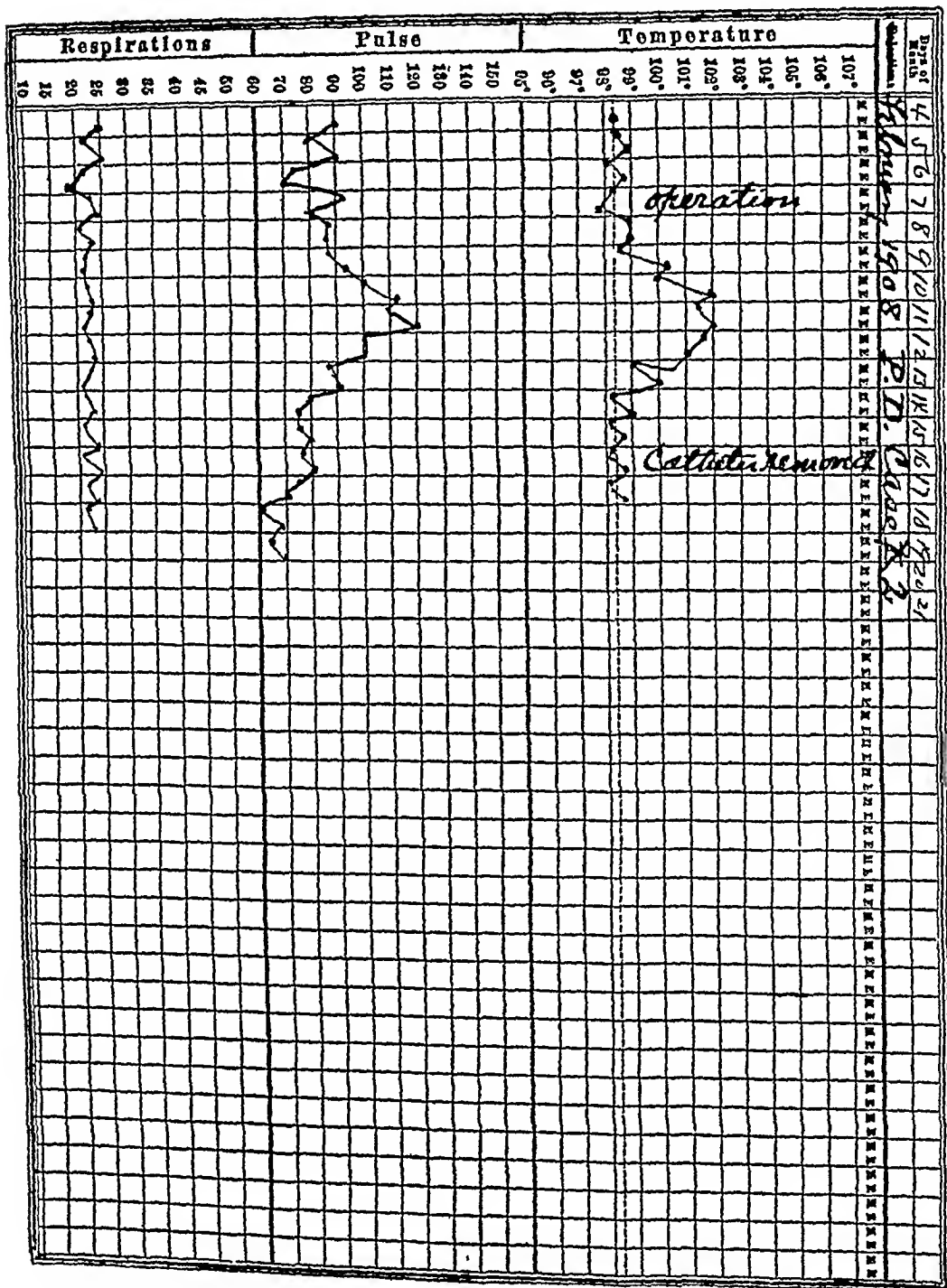


Chart of temperature, pulse, and respiration of Case 1 just before and following operation

pedicle was clamped and the tumor removed with scissors. A median one-inch incision was then made into the prostate just

below the urethral orifice, and the entire prostate gland was readily enucleated in one piece, including the prostatic urethra. The wound was packed with gauze, and the posterior portion of the bladder incision closed with two layers of catgut sutures. Walling off sponges removed and peritoneal cavity closed. Bladder was then washed out and closed about a drainage tube and one gauze wick, which led to the cavity from which the prostate was enucleated. There was very little postoperative bleeding. The wick was removed on the third day and the tube in one week, when catheter drainage through the urethra was instituted. Convalescence was uneventful except for an attack of epididymitis. Clinical chart of this case is reproduced in Fig 3.

On April 16, 1908, the patient left the hospital with the suprapubic wound healed solidly. Urine was voided through the urethra without pain, but at somewhat diminished intervals. The urine showed some turbidity due to pus, no blood. When seen one month later the patient was free from all symptoms and had returned to work.

Remarks—This case illustrates the value of intraperitoneal cystotomy for approaching a deep-lying tumor of the bladder, which may be quite inaccessible through the usual extraperitoneal cystotomy. The chief interest in the case, however, attaches to the nature of the growth. The pathological report by Dr W F Whitney was as follows:

"An elevated growth of the bladder-wall near the opening of the urethra about 3 cm in greatest diameter. With this was the prostatic gland, the outer portion of which was torn and lacerated, and on section it was found to be honey-combed with relatively large cysts between which there were very thin partition walls (Fig 4). Some of the cysts were filled with a little parenchymatous tissue.

"Microscopical examination of the prostate showed the cyst cavities to be lined with a flattened epithelium in places, and in others the epithelium was longer, and more cylindrical. The parenchymatous portions presented a papillary growth from the surface of the cysts which almost completely filled the cavities (Fig 5). The tumor from the bladder (Fig 6) was covered on the surface with epithelium, beneath this was a growth of glandular tissue in general appearance similar to that of the papillary

FIG 4



CASE I Photograph of median section of prostate showing cystic condition Actual size

FIG 5



CASE I Section of prostate showing the papillary epithelial ingrowths into some of the cyst cavities

below the urethral orifice, and the entire prostate gland was readily enucleated in one piece, including the prostatic urethra. The wound was packed with gauze, and the posterior portion of the bladder incision closed with two layers of catgut sutures. Walling off sponges removed and peritoneal cavity closed. Bladder was then washed out and closed about a drainage tube and one gauze wick, which led to the cavity from which the prostate was enucleated. There was very little postoperative bleeding. The wick was removed on the third day and the tube in one week, when catheter drainage through the urethra was instituted. Convalescence was uneventful except for an attack of epididymitis. Clinical chart of this case is reproduced in Fig 3.

On April 16, 1908, the patient left the hospital with the suprapubic wound healed solidly. Urine was voided through the urethra without pain, but at somewhat diminished intervals. The urine showed some turbidity due to pus, no blood. When seen one month later the patient was free from all symptoms and had returned to work.

Remarks—This case illustrates the value of intraperitoneal cystotomy for approaching a deep-lying tumor of the bladder, which may be quite inaccessible through the usual extraperitoneal cystotomy. The chief interest in the case, however, attaches to the nature of the growth. The pathological report by Dr W F Whitney was as follows:

"An elevated growth of the bladder-wall near the opening of the urethra about 3 cm in greatest diameter. With this was the prostatic gland, the outer portion of which was torn and lacerated, and on section it was found to be honey-combed with relatively large cysts between which there were very thin partition walls (Fig 4). Some of the cysts were filled with a little parenchymatous tissue.

"Microscopical examination of the prostate showed the cyst cavities to be lined with a flattened epithelium in places, and in others the epithelium was longer, and more cylindrical. The parenchymatous portions presented a papillary growth from the surface of the cysts which almost completely filled the cavities (Fig 5). The tumor from the bladder (Fig 6) was covered on the surface with epithelium, beneath this was a growth of glandular tissue in general appearance similar to that of the papillary

FIG 4



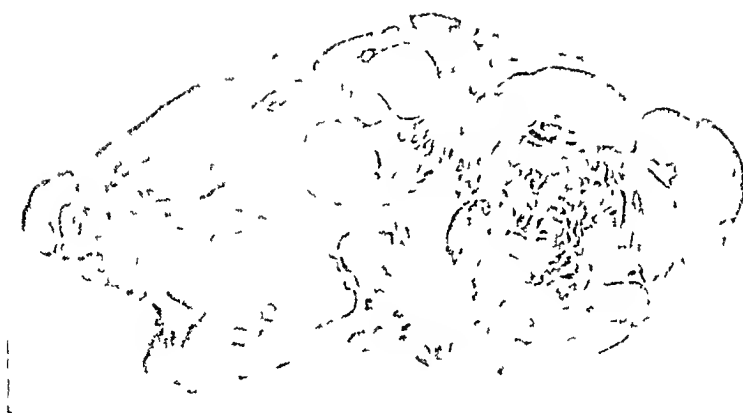
CASE I Photograph of median section of prostate showing cystic condition Actual size

FIG 5



CASE I Section of prostate showing the papillary epithelial ingrowths into some of the cyst cavities

FIG. 6



CASE I Section of tumor which projected into bladder showing the same process to a less marked degree

growth in the prostate, and in this tumor there also were a few small cysts.

“Diagnosis—Papillary cyst-adenoma of the prostate, with extension into the bladder-wall”

Dr. Hugh Young, in his accurate study of the pathology of prostatic hypertrophy,* in describing the glandular or adenomatous form, speaks of the dilatation of the acini, with papillary projection of epithelium which often occurs, and pictures some illustrative cases. The above case is the most extreme example of this process which I have seen hitherto reported and is sufficient, I think, to warrant the name of papillary cyst-adenoma. The condition simulates exactly the tumor of the same name which is of quite frequent occurrence in the female breast.

CASE II—P. D. (M. G. H., No. 156,894, Feb. 4, 1908). A man 39 years old, married, bartender. He is large and stout and has always been well. He has passed dark blood with clots painlessly for ten days. The urine has been clear for the four days just previous to entering the hospital. Dr. Chute, upon cystoscopy, discovered a papilloma of the bladder.

Cystoscopy by Dr. Davis, at the hospital. Bladder holds six ounces without discomfort. Just above the left ureteral orifice and close to it there is a pinkish papillary tumor about the size of a silver quarter. Remaining bladder-wall appears normal. Both ureteral openings normal in appearance and functionate naturally. The tumor lies so close to the left ureteral orifice that when the urinary stream is emitted the villous processes of the tumor are set in motion.

Diagnosis—Single, pedunculated, lobulated papilloma of the bladder.

Operation by C. L. S., February 7, 1908. Intraperitoneal cystotomy, removal of growth, closure of bladder and abdominal wall, drainage of bladder by No. 12 soft rubber catheter. Bladder drainage was discontinued February 16, that is, nine days following the operation. There was a slight amount of bleeding following the operation which lasted, evidenced by a slight reddish tinge in the urine, until February 22, that is, for fifteen days following the operation. He sat up February 28. March 1 he was discharged from the hospital. The urine at that time was

* Johns Hopkins Hospital Reports, xiv, 128

slightly turbid, with considerable pus, the cloudiness was lessening daily. The abdominal wound was solid. There was no frequency of micturition and no blood.

Pathological Report by Dr Whitney, February 7, 1908 (82-15) —“A soft papillary growth, many of the filaments being 1 cm in length. Microscopical examination showed fine vascular and fibrous stalks covered with a thickened layer of epithelial cells. As far as could be determined there was no infiltration of the deeper tissues.

“Diagnosis—Villous papilloma”

August 1, 1908, six months after the operation, the patient writes, “I am working every day, averaging about sixty hours a week. There is no blood in my urine and I have very little trouble with my bladder. My bladder is all right.”

CASE III—R G M (M G H, No 157,169, February 24, 1908). A man 41 years old. Has always had good health. He first had hæmaturia one and a half years ago. One year ago an appendectomy was done for acute appendicitis. Since the appendectomy he has had no hæmaturia until two weeks ago. For the past five days the urine has not been free from blood. There is slight frequency of micturition.

Cystoscopy by Dr Davis at the hospital. Bladder holds six ounces. Washes clear. No bleeding. On the right lateral wall of bladder, overhanging and external to the right ureteral ridge, is a lobulated papillary tumor of pinkish color with numerous shreds of fibrin attached. The urinary jet sets the tumor in motion. Whole tumor is seen to pulsate markedly. Left ureteral orifice normal. Bladder-wall generally injected but otherwise normal. No other tumor seen.

Diagnosis—Papilloma of bladder

A transperitoneal cystotomy was done February 28, 1908, by L D and C L S, the tumor removed and the base of the tumor thoroughly cauterized. The patient was discharged from the hospital March 17, 1908. Cystoscopy, before he was discharged from the hospital, showed a linear scar, healed perfectly, in line of bladder incision. A depression at the site of tumor. The right ureteral orifice was clear. A small loose ligature or suture was seen in one edge of the site of operation.

Pathological Report (82-74) by Dr Whitney —“A papillary growth measuring about 2.75 cm in greatest diameter with a

broad base and long vascular stalks extending from the surface. On microscopical examination thin stalks of fibrous tissue containing large blood-vessels were found covered with several layers of columnar epithelium. As well as can be determined there was no infiltration of the base.

“Diagnosis — Papilloma, probably malignant”

A letter from the patient dated July 24, 1908, that is, five months after operation, states that he is perfectly well. There is no longer any blood in the urine. He has no pain, and is doing his regular work.

CASE IV — A. J. (M. G. H., No. 157,973, O. P. D., No. 104,806, April 17, 1908). A man 33 years old, married. Patient sent from the out-patient department by Dr. J. M. Jackson. He has always been well. For the past seven months the urine has been bloody. Four months ago he first had pain on micturition. The hæmaturia was intermittent, at first every two weeks, then every week, then every three days. He has lost ten pounds in weight during the past seven months. A well developed man. Nothing remarkable in his physical examination. Urethral discharge purulent.

Cystoscopy by Dr. Davis at the hospital. Difficult because of persistent bleeding from the bladder. Surrounding the internal meatus is a shaggy, ulcerated and partly necrotic mass, beyond which a moderately inflamed bladder-wall may be seen. The cystoscopic picture suggests strongly an ulcerated, malignant growth. Rectal examination does not confirm this cystoscopic diagnosis.

April 28, operation by C. L. S. Transperitoneal cystotomy. Excision of tumor, curettage and cauterization of the base of tumor. Suprapubic drainage of bladder. Abdominal peritoneal wound closed completely. Bladder washed every hour for first twelve hours. May 6, or eight days after operation, the urine was clear and contained no blood microscopically. Ten days after operation sitting up in bed, May 25, discharged from the hospital to the doctor at home and to the out-patient department.

Urine examination, April 18. Normal, acid, 1016, slight trace of albumin, sugar absent, pus, blood and a few squamous cells are present.

Pathological Report by Dr. Whitney, April 28, 1908 (84-92) — “The tumor was a soft, solid papillary growth 4 cm. in

diameter, more or less lacerated Microscopical examination showed infolded masses of large epithelial cells separated by vascular bands of fibrous tissue

“Diagnosis—Malignant papilloma”

A report from the patient August 1, 1908, three months and a half after operation, said that he was “feeling well”

Remarks—The ordinary suprapubic approach to the interior of the urinary bladder is often unsatisfactory Unsatisfactory because the interior of the bladder is inaccessible, hemorrhage is not readily controlled The most striking fact about the Harrington operation, is the remarkably easy access to the interior of the bladder, especially to the base and posterior surfaces These are the parts most often requiring operation Not only is the access to the bladder rendered easy but manipulation of instruments within the bladder is unobstructed by this approach

The abdominal incision should be a long one, from the symphysis to the umbilicus If the abdominal wall is thin a shorter incision will be needed than if the abdominal wall is thick, because of fat and muscle The place of the incision in the bladder will be determined largely by the situation of the growth to be removed Most growths lie low in the bladder Ordinarily, therefore, it will be best to incise the bladder not high up but low down toward the rectal wall The tendency is to open the bladder too near the peritoneal attachment If this is unwisely done it will be found that in order to get to the base of the bladder an unnecessarily long posterior incision in the bladder-wall will be required The opening of the bladder posteriorly and low affords satisfactory access to the field of operation

A temporary suture of linen or catgut, placed immediately upon opening the bladder, as shown in the drawing (Fig 1), through all the coats of the bladder-wall at the most inferior angle of the bladder wound, will serve as a tractor of considerable assistance in steadying the bladder, and it will mark the situation for the lowermost sutures to close the bladder wound

The method of closure of the bladder wound in all cases here recorded was in layers Catgut being used for the mucous membrane and muscular layers and linen for the peritoneal layer Continuous sutures in each instance were used The peritoneal continuous suture was reinforced by several interrupted peritoneal linen stitches

All bleeding from the seat of operation within the bladder should be checked before closing the bladder. The ordinary method of control of hemorrhage by suture ligature, simple ligature and by actual cautery may be employed.

Postoperative drainage of the bladder was used in each of these cases, by the urethral catheter in three cases, by suprapubic drainage in two cases. The postoperative urethral catheter drainage is not always necessary. It may be positively indicated by a continuous oozing of blood. Frequent irrigation of the bladder without urethral drainage may suffice to get rid of accumulated blood.

One of these cases illustrates the use of the intraperitoneal cystotomy after exploratory extraperitoneal suprapubic cystotomy had shown the inaccessibility of the growth. This same case illustrates the ease and safety of suprapubic drainage following intraperitoneal cystotomy.

The intraperitoneal cystotomy of Harrington is not here advocated as a routine procedure for all urinary bladder growths, but for those which are inaccessible by the usual routes, and for those which require removal of the whole thickness of the bladder-wall in any part.

SIMULTANEOUS LIGATION OF BOTH EXTERNAL ILIAC ARTERIES FOR SECONDARY HEMORRHAGE FOLLOWING BILATERAL URETEROLITHOTOMY.

BY ALEXIS V MOSCHCOWITZ, M D ,

OF NEW YORK,

Adjunct Surgeon Mount Sinai Hospital

THE case I am about to report presents so many points of unique interest, that I have deemed it of sufficient importance to place on record

S W , aet 36, Austrian, was referred to me in March, 1907, by Dr B Lefkovics, with the diagnosis of nephrolithiasis I shall introduce only the important data in outlining the history of the case Ten years ago he was seized with an attack of sudden left-sided abdominal pain, followed by vomiting, at the time this attack was diagnosticated as appendicitis These attacks recurred at intervals of about two years About two and one-half years ago similar attacks began also upon the right side, and attacks upon both sides of the abdomen have recurred at varying intervals up to the present The later attacks are described by the patient as beginning in the back and radiating toward the front, to the bladder and testis and corresponding thigh The attacks are associated with frequent urination and high colored urine An X-ray plate taken shortly before I saw him, at the suggestion of Dr Hy W Berg, showed four calculi in the ureters, two on each side, and an indistinct shadow in the region of the left kidney The urine was alkaline, contained albumin, considerable pus and a few red blood cells

Operation was advised, but the patient left for Europe and was operated on in Vienna by Zuckerkandl June 15, 1907, for the left-sided renal calculus The other calculi were apparently undiscovered, although the patient avers that a number of X-ray exposures were made while at the clinic It is of interest to note that

* Case presented at a meeting of the Surgical Section of the N Y Academy of Medicine, Oct 2, 1908

eleven days after this operation an attack of right-sided renal colic occurred, which was regarded by Zuckerkandl as an example of contralateral pain. Since this operation the patient has had frequent attacks of renal colic alternating on both sides.

In January, 1908, he again came under my observation. A Röntgen plate made at this time showed bilateral ureteral calculi in the pelvic portion of each ureter. I operated on him July 20, 1908.

Operation—Bilateral ureterolithotomy, removing two calculi from the pelvic portion of each ureter—Through lateral extra-peritoneal incisions, and after dividing the aponeuroses of the external oblique in the course of its fibres, and the internal oblique and transversalis muscles across their fibres, the ureters were readily exposed, the calculi were easily found and removed through small longitudinal incisions. The ureteral incisions were closed by interrupted iodine catgut sutures. With the exception of one minute bleeding vessel in the retroperitoneal tissue not a single ligature had to be tied. As drainage I used a red rubber drainage-tube, about the size of the tip of the small finger, through which a strip of iodoform gauze had been pulled, which was placed against the suture lines in the ureter, the tube emerged naturally at about the junction of the middle and lower third of the cutaneous incision. Layer suture of the divided abdominal parietes completed the operation. The operation was one of the easiest I had ever performed, the entire duration of the completed operations being only 55 minutes.

The patient did very well for the next few days, except that on the third and fourth day there was rather more hæmaturia than I am accustomed to see after ureterotomy, this soon cleared up, however, and had entirely ceased on the fifth day. There was a minimal urinary leakage on the right side, just enough to slightly dampen the centre of the dressing. Primary union ensued, and the stitches were removed on the sixth day.

On July 27, one week after operation, the left drainage-tube was removed. The tube came away easily, but it was immediately followed by a tremendous hemorrhage, which stopped for an instant, and then recurred in sufficient quantity to fill a two-quart pus-basin half full. I promptly introduced a finger, which controlled the hemorrhage at once.

The patient was then anæsthetized, and the wound reopened.

A hole sufficiently large to admit the tip of the little finger was found in the external iliac artery, at a point where it was pressed upon by the drainage-tube. The vessel was ligated above and below the hole with a No 3 catgut ligature. The wound was then lightly tamponed with gauze.

I was beginning to congratulate myself upon the fortunate outcome of a disagreeable accident, when I lifted up the sheet with which the patient was covered, the sheet happened to catch in the safety pin, which pierced the tube upon the right side and pulled out the tube for certainly not more than half an inch. There promptly ensued an identical hemorrhage. The same conditions were found on this side, and exactly similar steps were resorted to to control the hemorrhage.

It is, I am sure, needless to say, that all pulsation ceased below the seat of the ligature, and both lower extremities became blanched. After the usual abdominal dressings were applied, both lower extremities were wrapped in cotton and bandaged, and patient placed in bed, with legs and trunk slightly elevated.

Despite the formidable hemorrhages, and in spite of the enormity of the operation the general condition of the patient was very fair. On the evening of the same day the toes were warm, of a delicate pink hue, and capable of slight active motion. On the following day slight femoral pulsation was to be felt, and on the third day an occasional flutter was noted in the dorsalis pedis artery. Thereafter his convalescence was entirely uneventful, and patient left the hospital with superficial granulating wounds on September 4, these have now healed entirely.

On the date of writing the above, September 30, the incisions are firmly healed, there is no hernia, pulsation can be felt in both femorals and dorsalis pedis arteries, though somewhat smaller than in the normal.

The points of exceptional interest in this case are the following:

- 1 That a bilateral secondary hemorrhage from the external iliac arteries was caused by pressure of drainage tubes.

- 2 That a simultaneous and successful ligature was performed upon both external iliac arteries.

In a cursory examination of the literature I have not been able to find a similar occurrence described, as the one that I have reported. Secondary hemorrhage caused by pressure of drainage

tubes has been described before and has been warned against, particularly in incisions upon the neck. I have also not been able to find another case of simultaneous ligation of both external iliac arteries. Both external iliac arteries have been tied by Makins (*Lancet*, Dec 2, 1892, and July 22, 1893) for bilateral femoral aneurism at an interval of seven and a half months. In Tillmann's "Verletzungen und chirurgische Krankheiten des Beckens" I also find a reference to a case by Watson in *Agnew's Surgery*, 1878, vol i, page 667. On referring to the original report, however, I find that Watson merely tied one external iliac. My case therefore appears to be the first case of simultaneous ligation of the external iliacs, successful or otherwise.

It would carry me far beyond the limits of this communication to discuss the probable routes of the re-establishment of the collateral circulation. Sir Astley Cooper's classic case in *Guy's Hospital Reports*, vol. 1, gives the collateral circulation eighteen years after ligation of one iliac to be as follows: (1) An anterior set, a branch from the ileolumbar artery communicates with a branch of the circumflex iliac, a branch from the ileolumbar artery with a branch from the obturator; two branches of the obturator artery with the epigastric and the internal circumflex of the deep femoral artery. (2) An internal set, branches of the obturator artery communicating with the internal circumflex branch of the profunda femoris. (3) A posterior set, branches from the gluteal, communicate with an ascending branch of the external circumflex; branches from the sciatic communicate with the internal and external circumflex and perforating branches of the profunda femoris. In cases of injury, similar to the one I report, there is also the important communication of the deep epigastric artery with the internal mammary. In my case the anastomotic circulation was restored very quickly, inasmuch as the dorsalis pedis artery had already begun to pulsate on the third day.

Excluding the interesting anatomical and physiological lessons involved, this case above all teaches the very important lesson, that drainage-tubes should be introduced in this locality with great circumspection or better not at all.

The case gave me some very anxious moments, and the patient can well be congratulated upon the fortunate outcome.

A FURTHER REPORT OF THE OPERATIVE TREATMENT OF ACUTE GONORRHOEAL EPIDIDYMITIS

BY FRANCIS R HAGNER, M D,

OF WASHINGTON, D C.,

Professor of Genito urinary Surgery in the George Washington University

THE preliminary report upon this subject was presented in March, 1906, as a thesis for admission to The American Association of Genito-urinary Surgeons and was published in The Medical Record of October 13, 1906. In The American Journal of Urology for May, 1906, an article appeared by Dr L Bazet of San Francisco entitled "A Preliminary Note on Epididymotomy for Blenorrhagic Epididymitis Based on 65 Cases," in which he states he first performed this operation in 1897, but as there was no published report of his work before May, 1906, I was unaware of his operation and for that reason no mention of it was made in my preliminary paper. His operation differs from mine in that the incision is differently located and that he does not open the tunica vaginalis which has been a seat of marked disease in all my cases. It is interesting to note that the results claimed for his operation are practically identical with those reported in this paper. In his communication he states that patients are up and about in from 4 to 7 days but does not state the rapidity with which the induration of the epididymis disappears, so of course I cannot state whether the results are as good as regards this feature as if the tunica vaginalis had been opened and the fluid nearly always present therein evacuated, the false membrane covering the epididymis removed and the tunica vaginalis irrigated with 1 to 1000 bichloride solution and drained.

Dr Bazet states that in the last eight years he has operated

* Read before the American Association of Genito-urinary Surgeons at Hot Springs, Va, June 2, 1908

on 65 cases and says that the operation is benign and that it ought to be performed as soon as the disease is diagnosticated. He has found the gonococcus present in one-third of his cases and has never had any atrophy, hernia, necrosis of the testicle or any mortality. In his preliminary report he does not state the percentage of cases in which pus was present nor the length of time the disease had existed before operation.

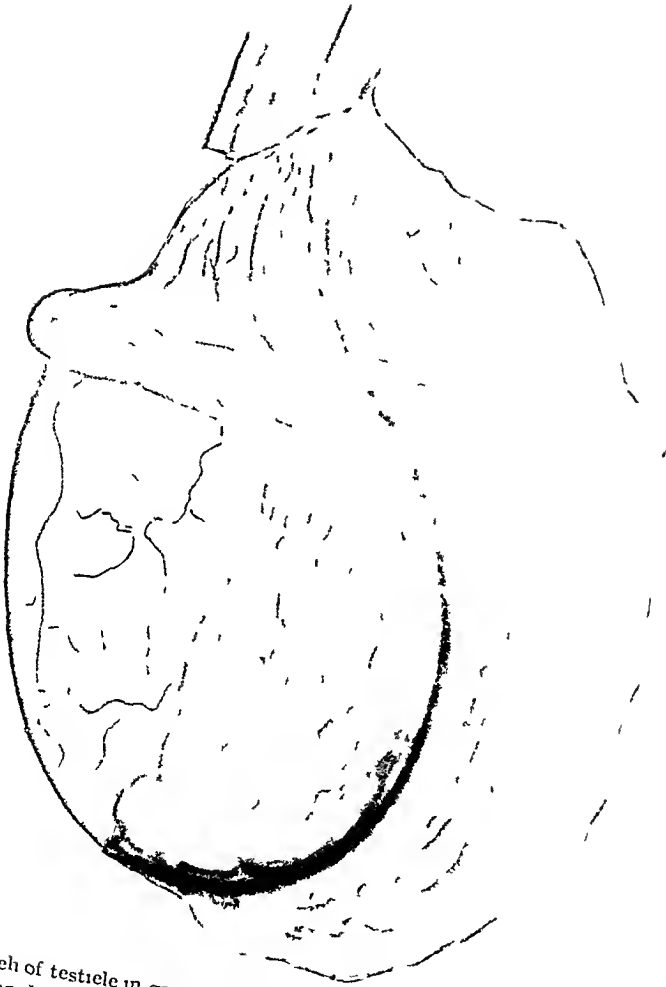
I will not go into the history of operations for gonorrhoeal epididymitis in this report as I took up this point in my original paper. At the time I operated on my first case I had never known of any open operation having been done for this condition. The operative treatment for gonorrhoeal arthritis was the procedure that suggested to me the surgical intervention in these cases. I feel it might be well to give a brief résumé of the operation as described in my previous paper, which operation I have found no reason to modify. At a point over the juncture of the epididymis and testicle an incision 6 to 10 cm long is made through the skin and parietal layer of the tunica vaginalis. After the serous membrane is opened all the fluid is evacuated and the enlarged epididymis examined through the wound. The testicle with its adnexa is delivered from the tunica vaginalis and enveloped with warm towels. The epididymis is then examined and multiple punctures made through its fibrous covering with a tenotome, especially over those portions where the enlargement and thickening is greatest. The knife is carried deep enough to penetrate the thickened fibrous capsule and enter the infiltrated connective tissue. When the knife is through the thickened covering of the epididymis a very marked lessening of resistance will be felt. If pus be seen to escape from any of the punctures, the opening is enlarged and a small probe inserted in the direction from which the pus flows, then by a backward and forward motion of the probe the opening is enlarged and the pus allowed to escape. By this method I believe there is less danger of injuring the tubes of the epididymis than by cutting with a knife. After the probe is passed in, pus will be evacuated by light massage in the region of the abscess and a fine pointed syringe

is used in washing out the cavity with 1 to 1000 bichloride of mercury, followed by physiological salt solution. The testis is then restored to its normal position, and in every case the tunica vaginalis is thoroughly washed with 1 to 1000 bichloride, followed by normal salt solution. The incision of the tunica vaginalis is lightly closed with a running catgut suture, a cigarette drain of gauze is then applied over the incision, the skin being brought together with a subcutaneous silver wire suture, the cigarette drain passing out at the lower angle of the wound. Silver foil and a sterile dressing are now applied and the part supported by a wide T bandage.

In every case in which I have operated fluid has been present in the tunica vaginalis, varying in amount from two drams to two and one-half ounces, the larger the swelling the greater the amount of fluid. This fluid resembles that seen in gonorrhœal joints, in that it is usually slightly blood-stained and contains a varying amount of fibrous material in which are entangled a few leucocytes. The parietal layer of the tunica vaginalis is congested and that portion of the tunic covering the epididymis is intensely congested and seems to be the seat of small punctiform hemorrhages. In a number of cases the whole of the body, the globus major and globus minor were covered by a false membrane, almost like that of diphtheria, which left a bleeding surface on removal. In fact it is an exception that this condition does not exist to some degree. This membrane is composed of fibrin, a few leucocytes and cell detritus, no gonococci were demonstrable in the membrane but they were present in the pus which escaped by puncture of the epididymis. I believe this description is identical with that in gonorrhœal inflammation of synovial membranes.

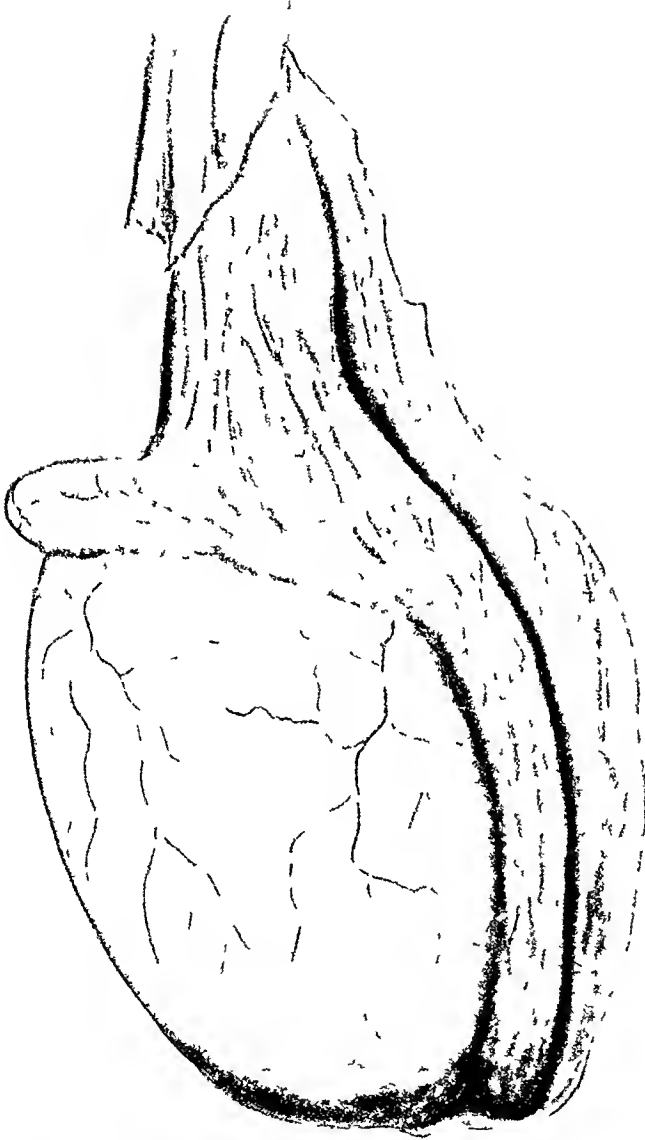
On palpation the affected epididymis is discovered to be very much thickened, being more marked in the region of the globus minor. Here it is often of stony hardness and, on puncture, blood of almost tarry appearance will exude. Next to the globus minor, the globus major appears to be the most involved portion and it is in this latter locality that I have

FIG. 1



Sketch of testicle in gonorrhœal epididymitis showing enlargement of the epididymis and the intense inflammation of the visceral and edge of the parietal layer of the tunica vaginalis

FIG 2



Sketch of normal testicle, tunica vaginalis removed

found pus containing gonococci in several of my cases. The body is infiltrated in the same manner but not to the same degree. In a few of the cases there was so much infiltration of the epididymis that the skin and subcutaneous tissue were dissected off the posterior aspect of the epididymis and punctures were made in this region with the exudation of dark blood and pus.

The relief from pain and rapid resolution seem to be just as great whether or not pus be present, and these results are, I believe, explained by the relief of tension due to the multiple punctures of the epididymis, the evacuation of the fluid from the tunica vaginalis and the drainage. The second day after the operation the cigarette drain is removed and the wound is redressed, when there is usually noted a small amount of ooze in the dressings. The drainage continues for from four to six days and in a week the wound is healed. The patients have, in every instance but one, been up and walking around, free from pain, by the seventh day. The remarkable feature is the rapidity with which the induration, not only of the epididymis but of the cord disappears, it being much more rapid than by any other method known to me.

Since March, 1905, over three years, I have operated on but 19 patients, not more than 10 per cent of my patients of this class, selecting the severest cases only because there may be some doubt whether this procedure affects the tendency to sterility. It is recognized that the organization of the exudate which blocks the tubules is a factor in the production of sterility, the rapid resolution which ensued upon the operation should therefore recommend this procedure as a preventive of sterility. I have operated on but one case that has not been absolutely relieved of all pain on recovery from the anæsthesia. This one case was a very acute and severe form of epididymitis of three days' duration in a very nervous young man, in which there were from thirty to forty miliary abscesses scattered through the epididymis. In this case it was necessary to employ two one-eighth grains of morphine hypodermically during the twenty-four hours following the operation but after

this time the pain entirely disappeared and the patient made an uninterrupted recovery

It is really remarkable to note the difference in the condition of these patients before and after operation. I have seen some writhing in pain, afraid to have the testicle touched or moved, but after recovery from the anæsthetic they would be absolutely free from pain and even considerable pressure over the affected organ would not cause complaint. The fall of the leucocyte count is rather interesting, the most marked being from 33,000 to 8400 in forty-eight hours. Along with the decrease in leucocytosis is a parallel fall in the temperature curve and pulse, the temperature reaching normal within thirty-six hours and remaining there, or with a very slight fluctuation, not over half a degree. There have been no cases of infection following the operation, nor have there been any cases of recurrence, atrophy of the testicle, or other distressing sequelæ.

A study of the accompanying table shows

Two cases only had had a previous attack of gonorrhœal epididymitis, in both of which the same testicle was involved in the second attack.

The duration of the gonorrhœa before the epididymitis developed varied from two weeks to six months and as a rule the earlier the epididymitis developed the severer the complication although one case that had had gonorrhœa for six months proved to be one of the severest I operated upon.

The pain in these cases has been of a most severe character not being relieved by the usual medical treatment followed in this disease. Quite a number of these patients experienced no comfort from large and oft repeated doses of morphine, whereas every case was absolutely free from pain immediately following the operation and none of them with one exception had to have any form of anodyne.

The amount of swelling varied, as accurately as we could measure it, from 15 to 31 centimetres in circumference. In most of these cases the induration of the cord and epididymis was very marked, the globus minor being the portion of greatest involvement, although in two cases the globus major

17	18	19	Dr Fuller's case 20	Dr Jones's case 21
None	None	None	3 times in 2 months	None
2 weeks	12 days	32 days	10 weeks	
2 days	6 days	15 days	2 days after 3rd case	7 days
Very severe No relief from medical treatment	Very severe Medical treatment unsatisfactory	Very severe No relief from medical treatment	Very severe Medical treatment unsatisfactory	Excruaiating
Unbearable	Unbearable	Exquisitely tender	Very tender	
2 inches in circumference	Very large	Enormous	9 inches in circumference	9 inches in circumference
Great mass of lymph Tunica vaginalis markedly congested 1 oz flaky white fluid		Great induration	Cord, globus major and minor all greatly indurated	Markedly enlarged and indurated
About 30 military abscesses through globus minor and major and body of epididymis	Intense inflammation and induration	Great induration	Great induration	Intensely injected Covered with lymph
1 ounce flaky white fluid	1 ounce flaky serum	1 ounce bloody fluid	1 ounce serous fluid	2 drams fibrino-purulent fluid
50 or 40 abscesses throughout	In globus minor	?	None	1½ drams in globus major and also in tunica vaginalis
Slight for 15 hours	None	None	None	None
103 5°	104°	100°	103 5°	102°
100°	97 8°	98 4°	99 4°	99 2°
15,000	33,000	15,800	No count	18,000
10,000	8,400 in 48 hours	No count	No count	12,000
Very numerous			None	None
None			None	None
Complete in 7 days	Rapid	Very, very rapid	Fairly rapid	Very rapid
On 7th day	On 4th day	On 3rd day	On 5th day	On 4th day
Cured	Cured	Cured	No return since	Cured

was the portion most involved and at operation was seen to be the seat of abscess formation.

The fall in temperature in these cases is rather significant. In every case the temperature has been lower after operation than before, and in one patient it dropped from 104 to normal in the first twenty-four hours after operation. Running parallel with this drop is a marked decrease in leucocytosis, the most marked being from 33,000 to 8400 in forty-eight hours.

Pus was present in 17 of the 21 cases, being in the globus minor in 12 cases, in the globus major and minor in 3 cases, in the globus major in one and in the tunica vaginalis in one case, this latter having no abscess involvement of the epididymis.

Of these 21 cases the gonococci were demonstrated five times in the pus from the epididymis and once from the tunica vaginalis when none could be found in the epididymis.

One of the most remarkable effects of this operation is the very rapid disappearance of the induration in both the cord and the epididymis. The wounds are usually healed in less than a week and unless rather carefully palpated the affected side would escape notice. None of the patients have had the hard nodular condition of the globus minor lasting for a long time, such as persists so frequently in those treated without operation.

Taking an average of the time in which the patients were up and about and entirely free from pain we find it to be five days. All these patients recovered without complications, none of them have had relapses and in some of the patients the improvement of the urethral condition following the operation has been very marked. We notice so often in gonorrhœal epididymitis treated medically that as soon as the epididymitis improves the urethral discharge seems to increase—this increase of discharge does not occur in cases upon which epididymotomy has been performed. It has occurred to me that possibly when the epididymis is punctured drainage of the vas may result. I cannot say definitely whether this operation lessens the liability to sterility of the affected side, but I might

add that I have carefully massaged the ampulla of the vas deferens and the seminal vesicles of the affected side and obtained motile spermatozoa, but I have never been absolutely sure that in massaging, fluid from the opposite side was not expressed, but I do know that it stops the pain, that the repair is very much more rapid and that the patients are most grateful for the relief of their suffering

FINGER ENUCLEATION OF THE TONSIL.

A METHOD FOR THE REMOVAL OF WHOLE TONSILS IN CHILDREN

BY FRANK S MATHEWS, M.D.,

OF NEW YORK,

Associate Surgeon to St Mary's Free Hospital for Children, Assistant
Surgeon to the General Memorial Hospital

UNTIL recently operations on the tonsils whether done by surgeons, pædiatrists, laryngologists or others have consisted in the removal of what may be called the excess of adenoid tissue. Recently, the laryngologists have attempted a more thorough operation using a variety of methods and instruments, in the endeavor to remove the entire tonsil.

In favor of the old method, tonsillotomy, is its simplicity as an operation. Moreover, in some hands the tonsillotome may remove nearly all of an elevated tonsil and a goodly portion of a buried one, though in the latter case, the anterior pillar is likely to suffer. Without doubt the vast majority of cases subjected to tonsillotomy in the past have been much benefited temporarily or permanently. On the other hand second or even third removals are not uncommon, especially if the first operation is performed in early childhood. The base, too, of a tonsil can afford a portal of entry to bacteria (including the tubercle bacillus) as well as a whole tonsil. Indeed, a child may have its first attack of follicular tonsillitis shortly after a tonsillotomy.

Some operators in their anxiety to remove the tonsil completely have replaced the exceedingly minor operation of tonsillotomy by a fairly formidable dissection requiring hours rather than minutes for its accomplishment. Tonsillectomy is desirable, but a quick easy operation is also. The operation to be described has been performed in a great many cases at St Mary's Hospital for Children with perfect satisfaction, with all kinds of tonsils, elevated, flat, buried and irregular. Many of the flat and soft tonsils have come out whole by this

method where we could not succeed at all by the old tonsillotome or newer snare methods. Before settling upon the method to be described we had experimented with several varieties of pillar separators with bistoury, long handled scissors, snare and punch and with a number of different positions for operating. These instruments have largely proved disappointing though they may have a distinct field of usefulness when the patient is an adult and no general anæsthetic is used.

We use ether as the anæsthetic of choice—under no circumstances chloroform, considering it more dangerous in these cases with their tendency to cyanosis than in the common run of surgical cases. Recall the fact that minor anæsthesia and childhood are no safeguards against the dangers of chloroform. Ether is given with paper cone and without preceding it with nitrous oxide. A child is etherized so quickly that the latter affords no advantages. Etherization is continued two to four minutes, depending on the child's age until a stage of primary anæsthesia is reached, but not to the stage of obliteration of pharyngeal or corneal reflexes. The danger of inspiring blood though slight is less when reflexes are not impaired. The patient is placed horizontally on a low table with the head at the end of the table but not hanging over. The operator takes the place of the anæsthetist at the head of the table. A gag is inserted and held by the anæsthetist who controls the head and presses upon the tonsil from without if desired. If the tonsil is thoroughly enucleated this is of small moment.

The jaws are gagged just widely enough to admit one or two fingers, wide gagging interferes with the child's breathing. No effort is made to control the movements of the fingers by sight. The whole operation is done by the sense of touch.

We describe first the removal of the right tonsil. The gag is placed in the left side of the mouth, the index or index and middle fingers of the right hand inserted and their palmar surface applied to the right anterior tonsillar pillar. By several strokes of the finger along the pillar from above downward a plane of cleavage is found and the tips of the fingers

felt to enter between the outer fibrous tissue-covered surface of the tonsil and the inner surface of the pharyngeal wall

If, as is less frequently the case, the tonsil adheres to the posterior pillar, the palmar surfaces of the fingers are then brought in contact with the exposed surface of the tonsil and the tonsil forcibly pulled forward, or rotated on its vertical axis, toward the mouth. The adhesions to the posterior pillar separate easily. Next one inserts the finger into the space made by separating the anterior pillar from the tonsil, turns the palmar surface toward the tonsil and brings it in contact with its upper pole. With the finger above the tonsil and the pillars thoroughly separated from it the tonsil is pushed inward toward the pharynx and downward toward the epiglottis, thus stripping it laterally from the pharyngeal wall. The tonsil, now out of its natural bed between the pillars, remains attached only by a band of mucosa at its lower pole. One can now, if he desires and as we have repeatedly done, tear away this remaining attachment with the fingers; but it is more difficult and time-consuming than the preceding steps of the operation and consequently we complete the removal by using a Mackenzie tonsillotome of small size and small aperture. The blade is drawn back, the instrument inserted with the finger over the aperture and the blade pushed home only when the finger feels that the tonsil has engaged.

The gag is then as a rule shifted to the right side of the mouth and the left tonsil enucleated with the fingers of the left hand. Inspection of the tonsil after removal shows a whole tonsil in a capsule of connective tissue. Rarely are any muscle-fibres of the pharyngeal wall found attached to it.

After the tonsils are out the finger explores the vault of the pharynx and if adenoids are present they are removed with the curette. We never use the finger or gauze covered finger to remove growths from Rosenmüller's fossa because of the certainty of thereby producing traumatism to the lateral pharyngeal wall in the vicinity of the Eustachian prominence and thereby favoring middle ear complications. The mouth

is more widely gagged for the removal of adenoids than for tonsils

This operation requires but a couple of minutes and the child is out from the anæsthetic almost immediately

We have performed the finger enucleation now many hundreds of times and believe it to be a method superior to ordinary tonsillotomy in that it is a complete removal of all tonsillar tissue. As in all other methods of removal so in this, the larger the tonsil the easier the removal. But the writer is convinced that he can remove many tonsils too flat or buried for success with the simple tonsillotome method, and others too soft for a tenaculum forceps to maintain its hold. In all cases after using the various pillar separators a further enucleation has been found possible with the finger.

After thorough enucleation with the finger it is not of great consequence what instrument one uses to detach the small remaining pedicle. It can be done with tonsillotome, blunt scissors or snare. The thing of first importance is the thorough enucleation of the tonsil from its bed between the pillars. We prefer the Mackenzie tonsillotome simply because one can use it by touch alone and avoid consuming time in sponging away blood to get a view of the parts.

There has been no case of bleeding requiring treatment after finger enucleation though we have had two fairly severe cases after tonsillotomy. The amount of bleeding during the operation is rather greater than with tonsillotomy. In the finger enucleation vessels are torn rather than cut and can readily retract into the normal tissues of the pharyngeal wall. No case of injury to the pharyngeal wall has occurred. It is avoided by keeping the fingers in contact with the tonsil and never directing them against the pharyngeal wall¹

¹ Some fear injury to the carotid in tonsillotomy. The tonsil is separated from the carotid by the superior constrictor, styloglossus and stylopharyngeus muscles. Moreover it lies posterior to the muscles, *i.e.*, nearer the vertebral column. The carotid will not be injured by finger dissection or the tonsillotome but may be by tonsil punches if pressure is being exerted from without. If pressure is to be made from without it should be applied in front of the vessels.

FIG 1



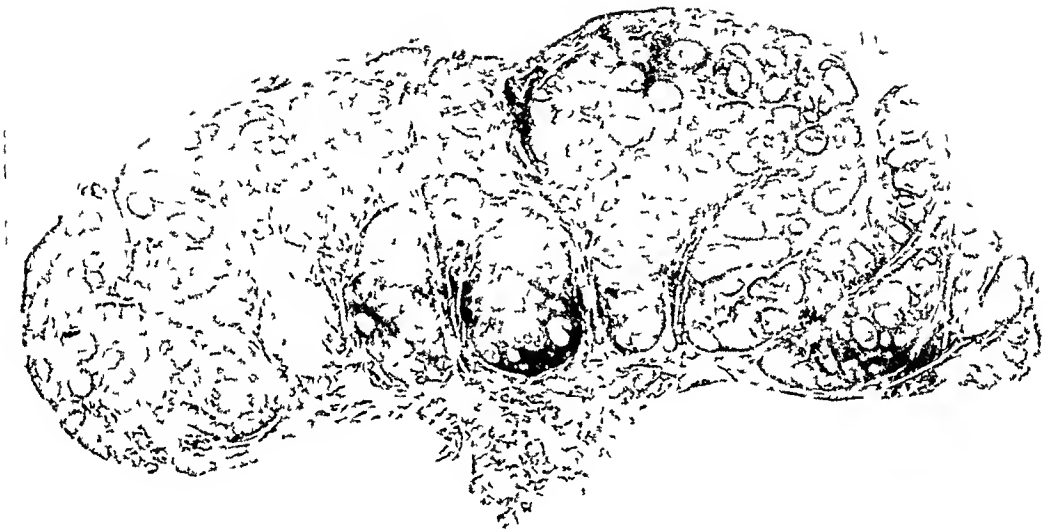
Section of a deeply buried tonsil The flat surface is the one directed toward the mouth

FIGS 2 and 3



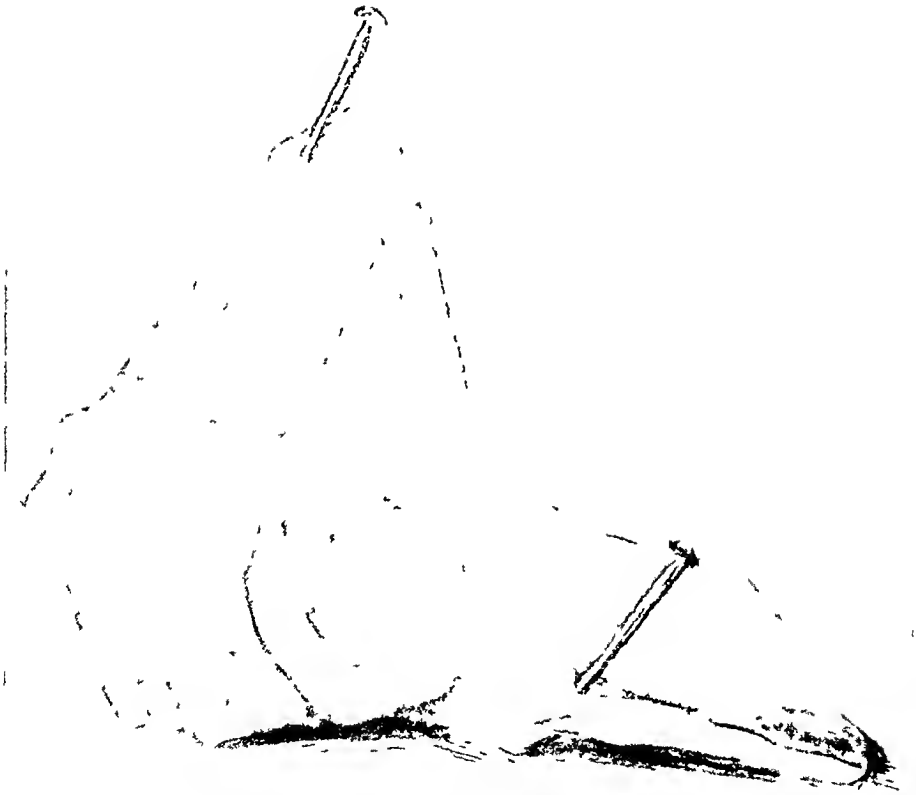
Small soft ragged tonsil with deep crypts, base deeply buried
Section of a large partially elevated tonsil, only partially removable by a tonsillotome

FIG 4



An elevated large and flat tonsil .

FIG 5



Portion of lateral wall of pharynx removed to show superficial portion of tonsil projecting to a moderate degree into fauces

FIG 6



Same specimen as in Fig 5 with anterior pillar of fauces dissected away so as to reveal the buried portion of the tonsil

FIG 7



Deeply buried tonsils after enucleation

The microphotographs shown illustrate different forms of tonsils removed by the method. Fig 1 is a deeply buried one. The flat surface is the one directed toward the mouth. This tonsil was removed by fingers alone with no help from the tonsillotome. Fig 2 shows the small, soft, ragged tonsil with deep crypts from which a volsellum would easily tear out. A good portion of this tonsil was buried from view. Fig 3 is a large, partially elevated one, part of the base of which would surely have remained *in situ* if the tonsillotome alone had been employed for its removal. Fig 4 illustrates an elevated large and flat tonsil. All these are whole tonsils as is shown by their capsule of connective tissue.

The two companion drawings (Figs 5 and 6) were made from a portion of a lateral pharyngeal wall removed at autopsy. The first shows very well an apparently small elevated tonsil easily removable with the tonsillotome. The second of these drawings shows the same specimen from which the anterior pillar has been dissected away, revealing the much larger buried portion of the tonsil. This is a common condition and very favorable to finger enucleation. The buried portion of a tonsil usually lies above and external to the visible one. There is usually a deep crypt leading from the upper part of the visible portion into the buried tonsil. The eight tonsils photographed (Fig 7) are good illustrations of deeply buried tonsils all removed entire. The view of them presented is that which one would have had by looking into the mouth, with the exception of the fact that the larger buried portion was covered by the anterior pillar. In most of them one can readily differentiate in the photograph the smooth mucosa-covered surface from the rougher connective-tissue capsule.

The advantages claimed for the finger enucleation of tonsils as above described are:

1. Whole tonsils are removed—a tonsillectomy
2. The anæsthesia is primary and of short duration
3. The operation requires but a couple of minutes even when adenectomy is added

4 The armamentarium is simple and cheap, but three instruments are used, a mouth gag, a Mackenzie tonsillotome, and an adenoid curette

5 Only one assistant is needed, either physician or nurse in the latter case one can give the anæsthetic himself

6 Skill in enucleating tonsils with the fingers is easily acquired by any one familiar with the anatomy of the parts. Our resident physicians learn to do it perfectly well after a few trials

7 As it is done entirely by feeling one is not interfered with by the presence of blood and mucus in the throat

8 Convalescence is no longer or more painful than after tonsillotomy

In brief, we have found the operation a quick, safe, simple and thorough one

BLASTOMYCOSIS OF THE SPINE.

DOUBLE LESION TWO OPERATIONS RECOVERY

BY GEORGE EMERSON BREWER, M D.,

Professor of Clinical Surgery in the College of Physicians and Surgeons,
New York, Surgeon to the Roosevelt Hospital

AND

FRANCIS CARTER WOOD, M.D.,

Professor of Clinical Pathology in the College of Physicians and Surgeons,
New York

THE following case of blastomycosis of the spinal column, with two separate and entirely distinct foci of infection, is of sufficient rarity and interest to justify this report

D S, male, aged 20, of Russian birth, came to America six months before his admission to the Roosevelt Hospital in December, 1906 His previous personal history was negative Three months before admission he began to complain of pain in the back He was examined at the out-patient clinic of one of our large hospitals, was told that his trouble was muscular rheumatism, and was given appropriate treatment The pain was not relieved, and several weeks later, there appeared pain at the epigastrium, which was more or less intermittent at first, and was generally more severe after his mid-day meal Shortly after this he noticed stiffness of the back, and moderate tenderness between the shoulder blades Two weeks before admission, his brother called his attention to a swelling over the upper dorsal spine.

On admission to the hospital, his chief complaints were pain and stiffness of the back, severe and almost continuous pain in the upper abdomen, general bodily weakness, loss of appetite and weight

Examination.—A poorly nourished boy with pale sallow complexion Heart and lungs normal Tenderness in left upper quadrant of the abdomen, but no muscular rigidity Liver and spleen not palpable On exposing the back, there

was found an oval tumor in the midline immediately over the spines of the second, third and fourth dorsal vertebræ. The tumor was covered by apparently normal skin, which was not adherent. There was no heat nor redness. On palpation the tumor was elastic but not frankly fluctuating, was about 8 cm. in diameter, could not be made to disappear on pressure. There was no pulsation. The mass was moderately sensitive. The spines of the second and fourth dorsal vertebræ could be palpated, but that of the third could not be felt. There was absolute rigidity of the upper dorsal spine.

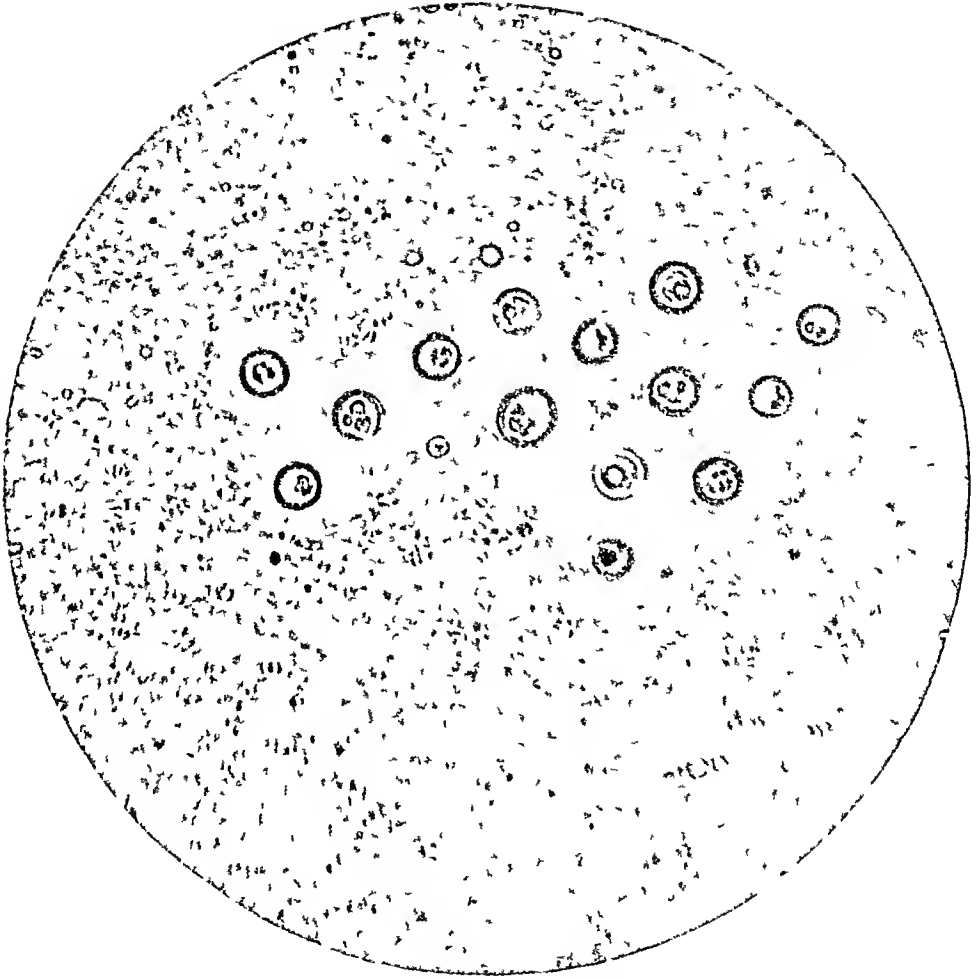
The patient was examined by several members of the hospital staff, and opinions were about equally divided between a diagnosis of soft sarcoma, and a tuberculous osteomyelitis of the arch of the third dorsal vertebræ.

Temperature on admission 99.8° , pulse 90. Urine cloudy, 1026, faint trace of albumin, no sugar, the sediment consisted of amorphous urates.

Two or three days later an aspirating needle was introduced into the mass and a syringe of dark colored pus removed. On microscopic examination the fluid was found to consist of pus and blood, and a large number of blastomycetes (Fig 1).

On December 20, under ether anæsthesia, an elliptical incision was made over the centre of the mass, which included a portion of the skin lying directly over the spinous processes of the second, third and fourth dorsal vertebræ. The skin and subcutaneous areolar tissue were then dissected away from the median line on both sides, until the entire tumor, covered only by the superficial muscles, was exposed. An attempt was then made to dissect the entire abscess-cavity free before opening it. In this we were unsuccessful. On opening the cavity about 100 c c. of dark colored pus was evacuated. The spinous process of the third dorsal vertebra was entirely necrotic and removed, the corresponding laminae were eroded and in places necrotic, the diseased areas were scraped away by a sharp bone curette. The walls of the abscess-cavity were thick and covered with large granulations. A portion of the cavity

FIG 1



Blastomycetes in fresh pus from abscess

extended nearly to the left scapula beneath the rhomboid muscles. The entire wall was dissected out, and all diseased bone and infiltrated muscle and fascia removed. After thorough irrigation and the application of a solution of 1-100 formalin, the wound was closed by several layers of buried sutures, and an aseptic dressing applied.

The operation was followed by a slight reaction only, the temperature reaching 101.5° on the second day. First dressing on the third day. Cigarette drain removed and replaced by small gauze wick. Stitches removed on the twelfth day. Primary healing of wound except at drain opening, which continued to secrete a small amount of yellow serum until his discharge, fifteen days after operation. Before his discharge from the hospital a careful examination was made of his entire body, with a view to finding a primary focus or point of entry of the infection. The result of the examination was negative. The sputum, obtained by forced cough, and the stools were examined for blastomycetes, but with negative result.

The patient returned to the hospital for dressing several days later, and the wound was found to be completely healed. The abdominal pain had largely disappeared, but the spine was still rigid.

On February 21 the patient again applied for admission to the hospital, complaining of backache and a painful swelling in the lumbar region. The temperature was normal; pulse 84. Hæmoglobin 95 per cent, leucocytes 21,400, polynuclears 80 per cent, eosinophiles 2 per cent. On examination, there was found a fluctuating tumor just to the left of the midline over the region of the upper three lumbar spines.

Two days later under ether anæsthesia, a curved cutaneous incision was made surrounding the periphery of the tumor, and the flap dissected toward the median line of the back. A large abscess cavity was entered containing about 120 cc of yellowish pus. Two or three of the spinous processes were found to be involved, and these with the walls of the abscess and surrounding infiltrated muscles were completely removed, leaving a large cavity, which could not be completely ob-

literated by suturing the neighboring muscles together. The wound, however, was closed as completely as possible and a cigarette drain introduced in the lower angle.

A careful examination of the seat of the previous operation was made, and no evidence of local recurrence discovered. Slight reaction followed the operation. First dressing on the seventh day, when the wound was found to be nearly united.

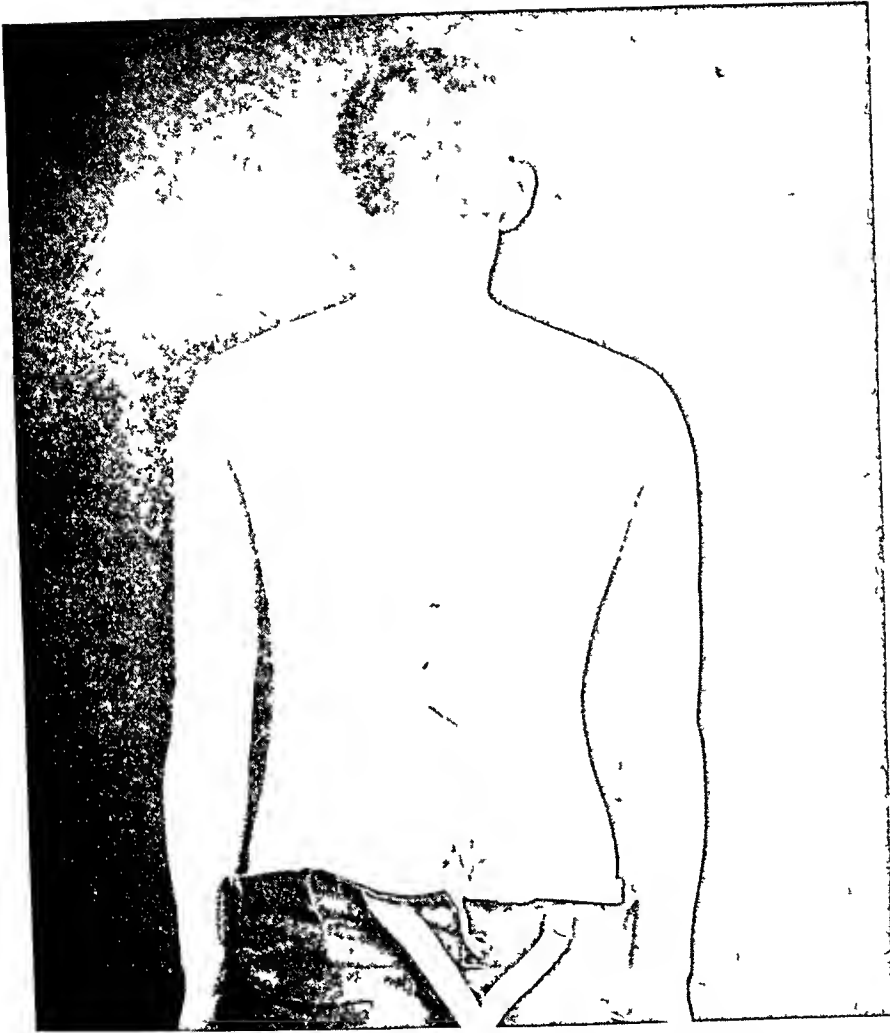
His condition remained satisfactory with normal temperature and pulse until the fourteenth day, when the temperature rose to 104° , pulse 114. On dressing the wound for the third time it was found to be badly infected, probably an accidental contamination at the previous dressing. Drainage was introduced, and daily dressings thereafter with irrigation and packing.

He made a slow convalescence, but was discharged from the hospital on the twenty-sixth day after operation with the wound nearly healed. He returned for dressings at intervals, and in a short time the wound was completely closed. After this he returned at infrequent intervals, each time reporting improvement in general health, and a gradual diminution in the stiffness of the back.

He was last seen and examined in March, 1908, about one year from the date of his last discharge from the hospital. At this time he reported that he was in perfect health, had gained about twenty pounds in weight, and was able to do his regular work as a waiter in a down-town restaurant. The wounds are solidly healed, no induration or tenderness. Mobility of spine nearly normal, a slight rigidity still present in the upper dorsal region, chiefly noticed when he attempts to arch the spine backward.

Fig 2 shows the appearance of the back in the erect position, Fig 3 when bending forward, and Fig 4 when bending backward. All of these movements as well as lateral bending of the spine, are executed without pain or discomfort of any kind.

FIG 2



Appearance of back at present time in the erect position.

FIG 3



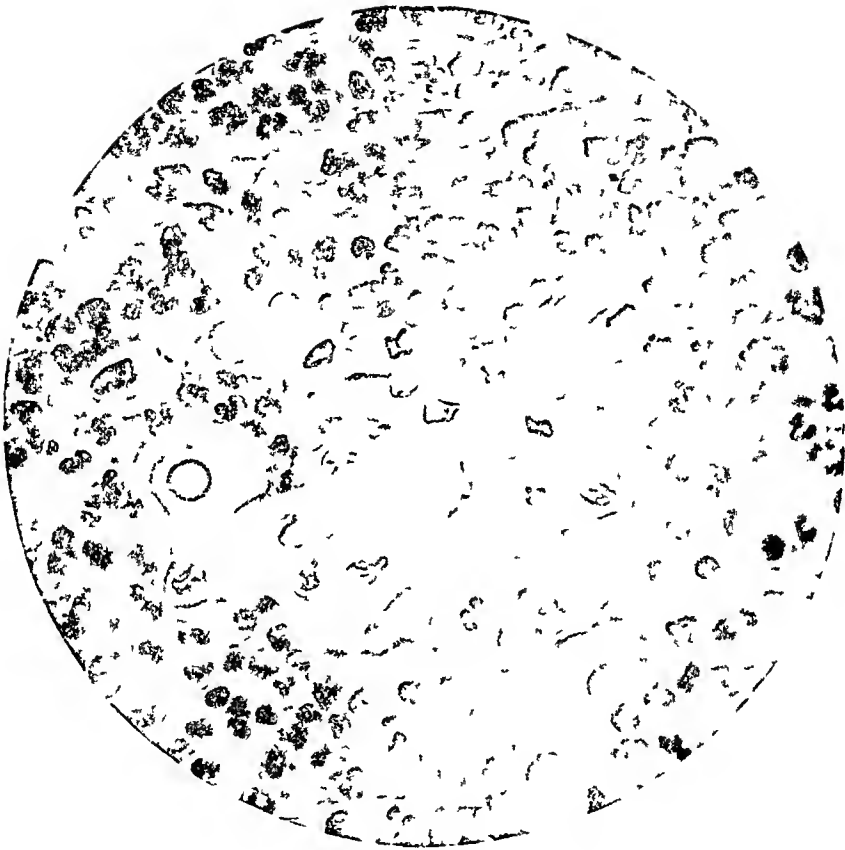
Appearance of back when bending forward

FIG 4



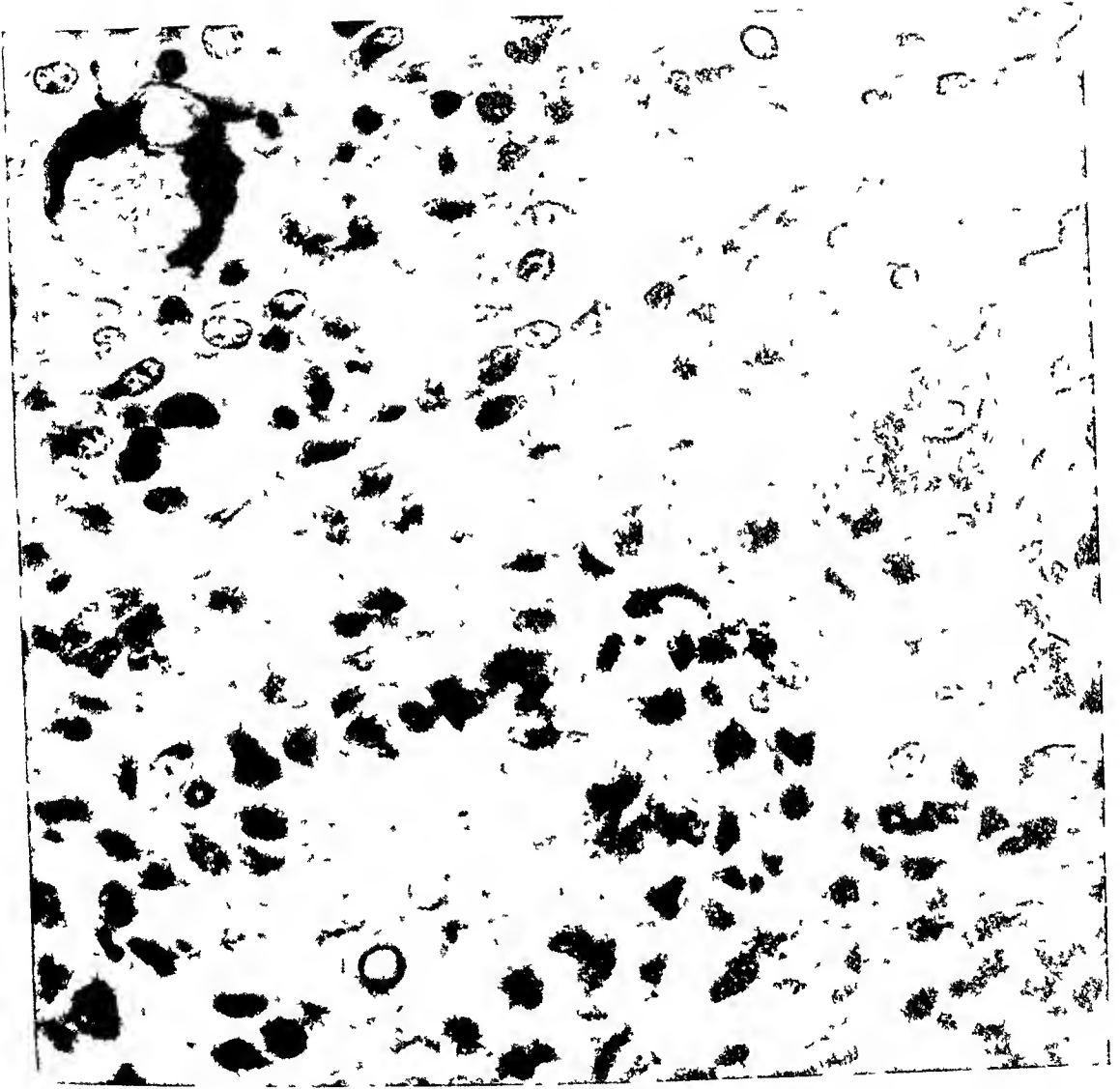
Appearance of back when bending backward

FIG 5



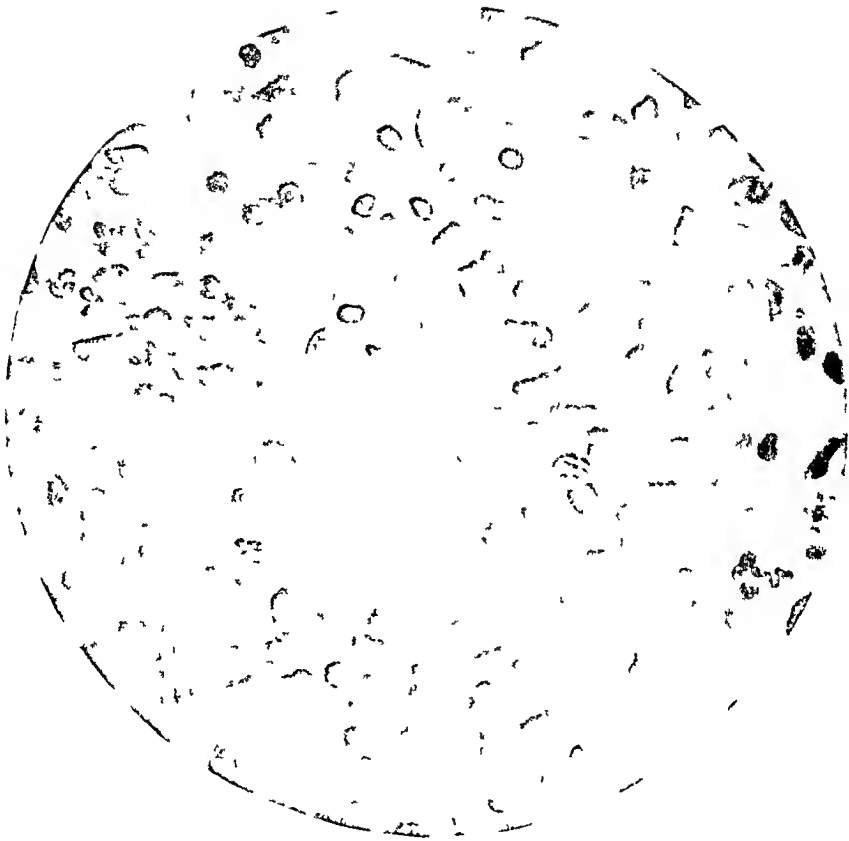
Mass of blastomycetes in granulation tissue. Many of the organisms are shrunken and irregular in form, others are well preserved. The granulation tissue is very loose and cedematous and contains numerous eosinophile and plasma cells. There is as yet no distinct giant cell formation in this portion of the tissue.

FIG 6



Granulation tissue containing a moderate number of blastomycetes and two phagocytic giant cells, also numerous plasma and eosinophile cells

FIG 7



Firm granulation tissue with a single giant cell containing only a remnant of a parasite. From the periphery of the abscess.

Examination of the fresh pus removed from the abscess at the first operation, showed a large number of blastomycetes (Fig 1) The organisms were doubly contoured, none of them were budding The central portion of the parasite contained from one to five small, spherical bodies which were highly refractile These particles were surrounded by a thick cell wall, and outside of this a broad gelatinous capsule The organisms measured from 10 to 25 micra in diameter. The fluid contained a large number of polynuclear neutrophile and eosinophile cells, showing albuminous and fatty degeneration On the addition of a small amount of aqueous solution of thionin, the clear peripheral portion of the blastomycetes took on a faint bluish stain, while the central part became deeply colored, especially the small spherical bodies

The material obtained for pathological examination consisted of fragments of bone from the spinous process and laminae and the abscess wall

Microscopical examination of the bone removed showed no blastomycotic organisms in or about the bone substance, there was, however, considerable inflammation with a rarefying osteitis In the wall of tissue which lined the abscess-cavity there were a very large number of parasites, many of them lying either surrounded by granulation tissue (Fig 5) or imbedded in giant cells (Fig 6) Occasionally giant cells were seen which did not contain any organisms. There were also many giant cells which contained partly digested organisms (Fig 7), either irregular in form or without the usual gelatinous capsule

The inner surface of the abscess wall was covered with debris, blood and leucocytes. External to this was a firm layer of granulation tissue containing parasites and many giant cells Outside of this was the connective and muscular tissue of the back The muscles were infiltrated with leucocytes which occasionally formed small miliary abscesses In some places the granulation tissue had become quite firm so as to form a dense capsule beyond which the organisms did not penetrate

The granulation tissue did not offer any peculiarity except

for the large number of giant cells and the fact that it contained a very large number of eosinophiles and plasma cells, many more than in granulation tissue due to ordinary pyogenic cocci. The poison excreted by the blastomycetes seems to incite a productive inflammation rather than the necrosing and suppurative types seen with the staphylococci.

The organisms were isolated in pure culture by Dr. Hans Zinsser, and when injected into animals (guinea-pigs) reproduced the human lesions perfectly, the animals frequently showing typical nodules or abscesses with giant cells, and granulation tissue. Each giant cell usually contained one or more of the blastomycetes. The lesions were especially interesting in the spleen and lung.

The blastomycotic nodules in animals resembled roughly fresh miliary tubercles. They ranged in size from minute points to the size of pin-heads.

The lesions in the abdominal lymph-nodes of some of the animals were very extensive, the nodes were large and hard. The changes were chiefly of a productive type, a moderate amount of connective tissue surrounding large masses of blastomycetes. Microscopically the lesions in all the organs were much alike, differing only in minor details and corresponding in most essentials to those observed by other investigators.

In the spleen the lesions showed an astonishingly large number of giant cells with nuclei about the periphery. In animals which did not seem to resist the infection well there was very little giant cell formation and much more tissue necrosis than in the animals which seemed likely to survive the infection and had to be killed. In the lung in guinea-pigs killed after four or five weeks, the nodules consisted of a central area composed of parasites of varying size, some budding and some retaining their extraneous capsule. They were usually close together, and where they were very numerous, portions of the lung appeared anæmic and resembled somewhat infarcts, but microscopically these appearances seemed to be due to collapse of the alveoli. Between the parasites were thin fibrils of connective tissue, the meshes of which often contained granular

detritus, resembling products of coagulation necrosis as seen in tuberculosis. Immediately about this, there were numerous young connective tissue cells and large swollen epithelial cells in the half destroyed alveoli. A moderate number of eosinophile cells were present. Giant cell formation was much less active in the lung than in other tissues, an observation previously made by Gilchrist.

The cultural characteristics of the organism were as follows. Growth was slow, small, grayish, punctate colonies appearing after forty-eight hours on glycerin agar. On agar slants they grew only to a slight depth, but very actively on the surface, forming a heaped-up yellowish creamy growth. On potato, growth was heavy and white. On litmus milk, there was growth but no change in the fluid. On gelatin, there was no liquefaction, but this was due possibly to the almost imperceptible growth at room temperature.

Unlike most of the organisms of a similar type which have been described, this form of blastomycetes grew very poorly in all fluid media, and to this may be due the absence of fermentation in dextrose, lactose, and saccharose tubes, and in dextrose, lactose, galactose, maltose, mannit, saccharose, levulose, and dextrin tubes of the Hiss serum waters.

Reproduction was by budding, and in no case even in the agar and gelatin hanging drops were mycelia observed. Observations on this point were continued for over three months on artificial media. In old cultures the daughter cells grow and bud again without detachment from the mother cells, thus forming strings of organisms. Such organisms may be seen separated from each other by a considerable distance, yet connected by a thin, straight, bridge-like line which takes the stain of the protoplasm of the cell.

In a case of Hektoen's there was apparent symbiotic relation between a pseudodiphtheria bacillus and the blastomycetes. In the pus removed from this patient there was morphologically a Gram-positive coccus which did not appear in the cultures after incubation. This apparent inhibitory effect of the

blastomycetes on other organisms agrees with the experience of Gilchrist and Stokes

The exact biological position of the parasite found in this case is still obscure. From the results of the cultures it is evident that the organism differs somewhat from those previously described in which abundant mycelium is produced. It also differs from the parasite producing the coccidioidal granuloma of the Pacific coast, cases of which have been recently collected by Brown (*Journal of the American Medical Association*, xlviii, 1907, 743). At present all that can be said is that it belongs to the group of organisms classified as blastomycetes.

The literature of the pathological aspects of the subject has been very thoroughly reviewed by Ricketts (*Journal of Medical Research*, New Ser., 1, 1901, 373), Buschke (*Bibliotheca Medica*, 1902), Bassoe (*Journal of Infectious Diseases*, iii, 1906, 91), and Coley and Tracy (*Journal of Medical Research*, New Ser., xi, 1907, 237), and need not be reproduced in full here.

ARTERIOVENOUS ANASTOMOSIS FOR GANGRENE.

THE REPORT OF A THIRD CASE

BY JOSHUA C. HUBBARD, M.D.,

OF BOSTON, MASS.,

Assistant in Surgery Harvard Medical School, Assistant Surgeon Boston City Hospital

CATHERINE C, 84 years old, entered the Boston City Hospital on November 23, 1907, with the following history

One year ago a sore appeared on the anterior part of the right ankle which was treated with applications of mutton tallow and alcohol. The skin came off and an ulcer resulted. The foot became swollen, tender and painful. For the last three weeks these conditions have been becoming worse so that sleep is prevented.

The big toe was found to be in a condition of dry gangrene with moist gangrene of three other toes and a portion of the dorsum of the foot.

The urine was high, 1020, acid, free from albumin and sugar.

On December 5 the thigh was amputated at the junction of the middle and lower thirds by Dr F B Lund. The pathological report states that the vessels were arteriosclerotic.

A bed-sore developed, but the patient was discharged on January 20 with sore and stump healed.

On March 14, 1908, she re-entered the hospital and stated that about the middle of February a "bed-sore" came on the left heel. The sore had been growing larger and more tender, especially rapidly during the last few weeks.

Examination at this time showed a very thin garrulous old woman of fair development. Lungs in backs many moist râles, slight dulness. Heart: no murmurs, regular in rate and force. Right leg amputated above the knee. Left leg normal, except for local condition. Cataract in right eye. Left heel presents on posterior under aspect an area $2\frac{1}{2}$ inches in circumference in which the skin and underlying tis-

sues are necrotic The foot was said to have been cold, but how far up the cool area extended is not known Urine pale, 1020, acid, free from albumin and sugar

On March 23 under ether an arteriovenous anastomosis was done An incision was made over Scarpa's triangle on the left leg and carried down to the vessels The vein and artery were dissected free for about three inches A Crile clamp was placed on the artery below the origin of the profunda and the artery was ligated with catgut as far down as possible A Crile clamp was then placed on the vein as low down in its course as it was possible and a catgut ligature about its upper portion The vessels were then divided Although the outside of the artery had appeared normal with no areas of arteriosclerosis, the lumen was found to be eccentric and to be about half its proper size with the walls thickened by soft tissue An arteriovenous anastomosis was then done connecting the upper end of the artery with the lower end of the vein Fine silk sutures on fine sewing needles were used, the walls of the vessels being turned so that intima came in contact with intima according to Carrel's method When the suture was complete the clamp was removed from the vein and then the artery There was some bleeding at the suture line which was controlled by two additional sutures The blood current then passed through the joint, the vein filled out and the pulsations could be felt below the anastomosis During the placing of the sutures the lumen of the vessel had been frequently washed out with salt solution in a medicine dropper The soft tissues and fascia were then sutured over the site of the anastomosis and the skin incision was closed A spica bandage was applied holding the thigh flexed on the body, and as soon as the patient was in bed, pillows were placed under the knee

Immediately after the operation the lower half of the leg was cold and the upper half warm, a definite line separating the two areas This line of demarcation gradually went down the leg till on March 27 the toes alone were cool At this

time a definite œdema of the lower part of the foot had appeared

By April 5 the foot was warm and comfortable and the patient up in a wheel chair. The superficial slough at this time was removed from the original area of gangrene over the heel, leaving a firm, dry, fibrous tissue base with an edge which bled somewhat. At about this time a bleb appeared over the dorsum of the big toe and some over the patella. These were pricked and dusted with powder and never showed any tendency to spread, though a discolored area persisted.

On April 26 it was noticed that without any apparent reason the whole leg had become decidedly œdematous. From this time there was no very marked change in the local condition except that a cool area about three inches wide encircling the middle of the leg appeared while the foot and upper leg remained warm. The sloughs on the heel and over the big toe began very gradually to extend and a bed-sore which had developed over the sacrum showed no improvement. The general condition of the patient became gradually poorer and she gradually failed and died from senility on May 26.

In review, the important features of the case are these. A foot previously cool is rendered warm and slightly œdematous by an arteriovenous anastomosis. The original area of necrosis remained latent after the operation, where as before it was said to have been growing rapidly, and its edge began to bleed. This condition continued till the general condition of the patient failed, when the area began to increase in size. Clinically, then, a very decided immediate change followed the operation and was therefore probably caused by it.

An examination of the local conditions after death was allowed and the pathological report by Dr Lawrence J Rhea follows.

Autopsy May 27, 1908.—On the left heel there is an ulcerated, depressed area about 3 cm in diameter. The tissues immediately about it are considerably discolored. There is an area of sharply demarked gangrene involving the great toe. On the inner side of the knee on the left side

there is a sharply outlined, punched out ulcer 4 cm in diameter and about 5 mm deep. The subcutaneous tissue has entirely disappeared. The underlying muscles are distinctly visible and show some necrosis.

In the inner border of Scarpa's triangle on the left side there is a linear scar running down in the direction of the leg, measuring 8 cm long. An incision is made from Poupart's ligament down through the central portion of Scarpa's triangle, the skin and subcutaneous tissue are dissected back and the femoral artery and vein exposed. These two vessels are carefully removed. At their upper end they are cut across as high up as possible, just a little above Poupart's ligament. The lower extremities are cut about half way down the leg. The tissues attached to this artery and vein are carefully dissected away and the artery and vein laid open. The upper portion of the femoral vein ends blindly a short distance below the profunda vein. In this same region the lower end of the femoral artery ends as a blind sac. In both the lower end of the artery and upper end of the vein the lumen was occluded by a light gray, rather elastic tissue which is slightly adherent to the vessel wall (Thrombi which are undergoing organization). The lumen of the upper end of the femoral artery is continuous with the lower end of the femoral vein. The point of union of the lumens of these two vessels is quite distinct and is marked by a band of thickened, dense scar-tissue. Immediately below this point of union there are seen a set of normal valves upon the vein. Both the artery and vein in the region of their point of union contain a pale elastic tissue which is quite firmly adherent to the vessel wall. This material (thrombi) would seem to have, at least for the most part, occluded the lumen of the vessel. The femoral artery is thickened throughout, the portion examined has practically lost its elasticity and shows several areas of calcification. The lower end of the artery, which has been tied off, is thicker than the upper end, its lumen being greatly infringed upon.

Remarks—The artery shows marked arteriosclerosis

Its lumen is quite markedly narrowed. This narrowing seems to be more marked, comparatively, below the profunda artery than above it. The upper end of the femoral vein and its branches are occluded by a thrombus which is undergoing organization. The lower end of the femoral artery contains a thrombus which is being organized. The point of union between the upper end of the femoral artery and the lower end of the femoral vein seems to have entirely healed, scar-tissue being deposited. The thrombus found at this point of union and extending into both the artery and vein shows some organization. Since these vessels are already diseased and the patient is old and her recuperative properties greatly decreased, it is difficult to tell how long this thrombus has been forming.

Had no post-mortem examination been allowed I should have considered the operation to have been a success. Now, however, the age of the thrombi in the vessels is the determining point as to the success or failure of the anastomosis. If the thrombus at the anastomosis formed soon after the operation and is equally old with those in the ligated vessels then the operation was a failure. If, however, it formed later due to the failing strength of the patient at a time when clinically a sudden and marked oedema appeared in the leg then it is fair to consider that the operation had been a success. When the pathologists cannot determine the relative age of thrombi who is to decide?

Of the three cases of arteriovenous anastomosis done by me for senile gangrene the first was reported in the ANNALS OF SURGERY for October, 1906. The patient was seen in May, 1908, and the amputation stump was found well nourished (Amputation was done at the point of election on the tibia for gangrene of the foot existing previous to the anastomosis). The second case was a failure in that a clot formed immediately at the site of the anastomosis. The success or failure of this the third case is not determined.

As I have watched the reports of cases of arteriovenous anastomosis and as my own ideas have become crystalized

from the observation of these cases, I feel that so far nothing very brilliant has been accomplished I shall nevertheless continue to suggest this treatment in appropriate cases since the operation is free from all shock and can do no harm other than necessitate, if it fail, a second etherization for an amputation

A MODIFICATION OF THE GRITTI AMPUTATION WITH SPECIAL REFERENCE TO NERVE BLOCK- ING AND REGIONAL ANÆSTHESIA.

BY JONATHAN M. WAINWRIGHT, M.D.,

Surgeon in-Chief of the Moses Taylor Hospitals, Scranton Pa., and Buffalo, N. Y.

RECENT advances in surgical physiology have placed on a firm foundation the necessity of nerve-blocking during amputations that may be accompanied by shock. In numerous publications various authors have conclusively shown that if the nerve impulses are so blocked that the additional depressing influences produced by the amputation are prevented from reaching the medullary centres, amputations and other operations can be done with no effect whatever on the blood-pressure, providing there is not much hemorrhage.

Several years ago the author published a large number of animal experiments in which it was conclusively demonstrated that such an effect could easily be obtained by spinal anæsthesia. If an anæsthetic such as stovaine is injected into the spinal cord so as to produce a complete anæsthesia, the lower parts of the body are practically entirely cut off from the vital centres. Trauma produced on these parts has no more effect in causing shock than if this trauma was made on another individual. Since this publication we have carried our own work a step further and found that the same result can be obtained if the principal nerves in the limb are injected with stovaine. This procedure thoroughly carried out has an efficient effect in preventing shock and also eliminates the small danger which is present with spinal anæsthesia.

The Gritti amputation admits of such a simple method of applying nerve-blocking or regional anæsthesia that we believe the technic which has been adopted for this purpose will be of interest. First of all it is understood that the term "Gritti Amputation" applies to all amputations at the knee in which the patella is attached to the sawed end of the femur. By

this method amputation can easily be performed with practically no pain and without general anæsthesia. However, if the patient's condition warrants it we generally use ether also, in order to eliminate the psychic influences that are present during an operation in full consciousness.

Technic—After the usual cleansing the skin is infiltrated with stovaine in the upper angle of the popliteal space. A skin incision about two inches long is then made in the upper angle and the external and internal popliteal nerves are easily found in this situation. In order to prevent any pain from the injection of the nerves a few drops of stovaine are applied to the outside of the nerves and after waiting a moment a small hypodermic needle can be thrust into the nerve trunks and enough of the stovaine solution injected to cause a marked swelling of the nerve trunk. This being done to both nerves the incision is then deepened and the popliteal artery identified and ligated in the upper angle of the popliteal space. The vein is not disturbed at this point, as it is important after ligating the artery to elevate the leg for a few moments to allow as much blood as possible to flow back into the general circulation. The stovaine solution used is 2 per cent or 4 per cent according to the quantity one expects to use.

The next step is to carry the previous longitudinal skin incision straight down the popliteal space to the level of the tubercle of the tibia. An incision is then carried straight across the front of the leg on a level with the tubercle. If ether is not used, it is necessary to infiltrate this incision. When ether is used this need not be done. The skin flap thus outlined is dissected up for a short distance until the ligamentum patellæ is exposed. The knee-joint is then opened through the ligamentum patellæ, all the capsular structures cut away and the tissues in the popliteal space cut straight across on a level considerably below the point of injection of the nerves and the ligation of the artery. This leaves the head of the femur projecting from the wound. The entire head is sawed off sufficiently high so that the patella will come down over it without any tension. The posterior cartilaginous surface of the patella is then sawed

off, so that a flat bony surface can be applied to the end of the femur

Satisfactory stumps have been obtained by us through fixing the patella in place by means of heavy chromic stitches passed through the periosteum and available fascia surrounding both bones. However, the pull of the extensor muscles is sometimes considerable, so that it has been found better to re-enforce these fascial stitches with one heavy chromic stitch passed through drill holes in both bones. This having been done the muscles and fascia surrounding the bones are brought snugly together with plain catgut stitches and the skin sewed in such manner that when finished it presents the shape of an inverted "T," the skin suture being on the posterior surface of the leg and some distance above the lower end of the stump.

The advantages of the above plan of operating have been very apparent to us and we believe that with its use a number of cases have been led to a successful recovery who would have died without this plan of operation. We have published a number of the blood-pressure charts taken during these operations which show that they can be performed in this way with practically no effect whatever in regard to shock, furthermore, the possibility of amputating by this plan without ether is of great advantage in certain cases. Two of the cases have been brought to successful recovery by amputating without ether, and in both cases (numbers 7 and 11 below) we feel that the administration of ether alone would have been fatal even though no operation had been done.

Another great advantage which belongs to the Gritti amputation in general is the satisfactory condition of the stump. Every surgeon who does many amputations will recall cases where the patients have complained bitterly of pain in the stump, although the stump itself may be apparently in good physical condition. These conditions are very distressing to both patient and surgeon, and unfortunately a revision of the amputation does not always give relief. In one case of our own after an amputation of the arm, the pain was so great that we were led to cut all the nerves in the brachial plexus, and

even this procedure gave practically no relief Of the twelve cases in which we have done the Gritti amputation in the last few years we have been able to trace six for periods varying from two months to three years, none of the cases traced have complained of any pain whatever in their stumps

A third great advantage in this form of amputation lies in the fact that the patient can, if he wishes, use a peg leg This is of greater importance to working people as artificial legs are expensive and frequently get out of order if used in very active work Of the cases we have been able to trace five have been doing active work in the mines with peg legs which are practically less expensive than ordinary shoes While most of these cases have artificial legs for dress occasions, they nearly all say that they can walk just as well and a few can walk better with their peg legs

For the above reasons we have come to feel that the Gritti amputation as outlined above is an ideal method and it is now the one which we use in any case around the knee-joint, and we believe it is much preferable to any form of operation which leaves a tibial stump less than six or eight inches long

ABSTRACT OF CASES

CASE I —Leg caught between bumpers of car, gangrene followed and amputation in middle of leg two weeks after accident Second amputation, Gritti type, on account of sloughing of flap ten days later Nerves not blocked On discharge stump healed and in good condition, no pain Left for Old Country

CASE II —Leg amputated about 4 inches below knee for run-over accident when patient was three years old Came to hospital on account of painful conical stump Stump of tibia is about 4 inches long and is badly ulcerated over end Typical Gritti amputation, ether without nerve-blocking On discharge wound healed and stump in good condition Examined three years later, is working in mines says that he never has any pain while at work He uses a peg leg which he bought for \$2 00, has an artificial leg which he uses when dressed up

CASE III —Large mass of coal fell on leg, hopelessly crushing bones and soft parts Immediate typical Gritti amputation,

FIG 1



CASE V —The stump in Gritti's amputation two years after operation

ether without nerve-blocking. On discharge wound healed, stump in good condition. Seen three years later, stump in good condition. Has no pain at all, working as switch-tender in mines. While working uses a peg leg which another miner made for him; uses an artificial leg for dress occasions.

CASE IV—Leg crushed between a car and a mine pillar. Crushed portion became gangrenous, presumably from blood clot in one of the large vessels. Eight days after injury typical Gritti amputation. Ether with nerve-blocking. On discharge wound healed, stump in good condition. Examined three years later, has no pain whatever in stump. Has worked regularly as an upholsterer, uses an artificial leg which carries all the weight on the end of the stump.

CASE V—Leg run over by mine car twelve hours before admission, brought to hospital in bad condition of shock and hemorrhage. Condition on admission very poor, so that patient had to be given intravenous infusion, crushed leg dressed temporarily and patient put to bed to react from primary shock. Twelve hours later patient in fair condition, a typical Gritti amputation performed with nerve-blocking. Pulse rate and blood pressure same at end of operation as at beginning. On discharge wound healed, stump in good condition. Seen two years later, has no pain whatever, doing work in the mines. Uses peg leg while at work, has a patent leg for dress occasions. Plate I shows the stump in this case two years after operation. In this case the patella was fixed to the femur with chromic stitches passing through the periosteum and fascia only.

CASE VI—Buffalo Branch. Severe crush of leg. Immediate Gritti amputation. In bad condition on admission and died twenty-four hours later from shock and hemorrhage.

CASE VII—Leg run over by mine car. Admitted to hospital seven hours later in marked shock, pulse 110, temperature 98. Leg dressed temporarily and patient put to bed to await reaction. The following morning condition was considerably improved, Gritti amputation with regional anæsthesia, as outlined in text. Operation was painless and blood pressure readings during operation show practically no change. Wound did well, but patient died three weeks later as the result of other injuries.

CASE VIII—Crushing injury to leg. Immediate Gritti amputation. Ether with nerve-blocking. Blood pressure before

ether 130, at end of operation 140 Seen eighteen months later, has no pain, working in mines as a pump runner While working uses a peg leg which cost \$15, has an artificial leg for dress Says that he can walk much better with the peg leg than the artificial one

CASE IX—Buffalo Branch Crushing injury to leg Marked shock on admission, intravenous infusion before operation, typical Gritti amputation under ether Seen eight weeks later, wound healed, patella firm, no pain Since left for Old Country

CASE X—Run over by car four hours before admission In considerable shock on admission Operation delayed nine days in hopes of saving leg Typical Gritti amputation, ether, nerves not blocked On discharge wound healed, stump in good condition Left for Old Country

CASE XI—Struck in popliteal space by a piece of coal shot from blast Taken home at first in care of family physician Popliteal vessels were evidently cut and signs of gangrene appeared at once Brought to hospital on day following injury, general condition very bad, loud double heart murmurs, large amount of albumin and casts in urine, looks septic, and area of gangrene is extending Administration of ether impossible Two days after admission typical Gritti amputation with regional anæsthesia, as outlined in text Operation painless and without shock Immediate satisfactory recovery, and later the heart murmurs and urinary condition entirely cleared up

CASE XII—Run over by car one hour before admission On admission general condition good Immediate Gritti amputation with ether and nerve-blocking, no shock produced by amputation Seen six months later, no pain, has not procured a satisfactory artificial leg

SKIN GRAFTING OF THE HEEL: BY MEANS OF A FLAP FROM THE OPPOSITE THIGH.*

BY C. J. HABHEGGER, M.D.,

OF WATERTOWN, WISCONSIN,

Attending Surgeon, St Mary's Hospital

THE condition that in this case made a skin grafting operation of the heel necessary, was not only a defect of the skin proper, but a loss of the subcutaneous fat, which not only acts as a buffer for the bone, but also, by interposing a soft cushion between it and the skin protects the latter from injury. When we consider the anatomical relations of the heel, formed as it is by the os calcis, a very strong bone, and its muscular and ligamentous attachments, and covered by this cushion of fat and skin, it is easy to understand the reason why in crushing injuries of the foot, the soft parts are frequently torn away from the bone without injury to the latter. This separation may be complete at the time of injury, or may take place later as in the case to be reported, owing to infection or insufficient blood supply of the torn soft parts. When such separation does take place, the heel is practically formed by the os calcis, to which, when the parts are healed, the new skin becomes intimately adherent. This new skin, even though healthy, cannot long resist the injury to which it is daily subjected, and soon breaks down and ulcerates. For this reason this patient, who has had such a crushing injury of the foot, came to us; and it was imperative, not only to remedy the skin defect, but also to furnish, if possible, a new cushion of fat. This cushion is not furnished in the ordinary methods of skin grafting, such as the Reverdin and the Thiersch. The new skin in such methods also becomes intimately adherent to the bone and will not long remain intact. The only way the heel can be covered and furnished with a new cushion is by

* Read, and case shown, before the Jefferson Co Med Soc, Sept, 1908

some sort of a flap operation, the flap being taken from a part of the body which naturally has a thick layer of subcutaneous fat

Numerous methods of flap grafting have been devised for different parts of the body. Among the best known is the Italian method of covering defects of the nose by means of a flap from the arm, the hand being placed on the head and held in that position until healing takes place. Skin defects of the hand are frequently covered by flaps with two pedicles from the abdomen or back. Defects of the leg have been covered by a flap taken from the opposite leg. In all of these, the object is merely to secure healthy skin, that is pliable and will not contract. In this case, however, it was necessary, as already stated, to furnish a fatty cushion besides covering the heel and as the results were fairly good it was deemed of sufficient interest to report.

The following report consists of a short history and a description of the condition of the foot, together with the various steps of the operation as it was performed.

H K, age eighteen, referred to me by Dr T F Shinnick, Watertown, Wisconsin. Twelve years ago while flipping a train got his left foot caught between the air brake and the wheel. The injuries of the foot sustained at that time as near as can be ascertained were as follows. The soft parts were torn from the bone from a little below the ankle down to the toes. The foot was literally stripped of its flesh down to the toes but the ankle joint was not injured. The tarsal bones, the os cuneiform and the cuboid, near their articulation with the metatarsal bones, were either fractured or dislocated, as were also some of the phalanges. The parts were restored as nearly as possible and the skin sutured. In healing, a great deal of the skin became gangrenous and had to be cut away. So much for the injury.

The examination of the foot at the time of the operation showed that there is a slight limitation of motion in the ankle-joint, especially of flexion, it being limited to ninety degrees. Beginning a little below the ankle-joint, the foot is (Fig 4) covered by scar-tissue which is smooth and shiny but somewhat dis-

colored. It hugs the bony skeleton very closely but is quite pliable, except over the heel where the scar is intimately adherent to the bone. This scar-tissue extends on the dorsal surface as far forward as the base of the toes, and on the sole of the foot it covers the heel. Laterally it extends in an irregular manner down almost to the sole, over the cuneiform and cuboid bones and the proximal ends of the metatarsal bones, irregularities can be seen and felt which are either callosities, the result of fracture or slight dislocations of the bones themselves. The arch of the foot is not broken down, but the tarsal and tarsometatarsal joints are ankylosed. The toes are considerably crippled, the fourth and fifth are dislocated forward at the metatarsal phalangeal joints, and the distal phalanx of the third backward, giving that one the appearance of a hammer toe. Motion such as flexion and extension is entirely lost, except in the great toe and the second toe, where it is very much impaired. All the other functions of the foot are quite well preserved. The skin of the heel, as already stated, is very intimately adherent to the bone. Scattered over the heel are numerous ulcers of different sizes which have persisted almost continuously since the injury and from which he seeks relief.

Operation, March 31, 1908. The preparations for the operation were very thorough. The patient was put to bed for four days and the leg and foot were shaved and repeatedly scrubbed with soap and water and warm bichloride dressings 1:2000 applied every four hours. The opposite thigh was also shaved and thoroughly scrubbed and warm bichloride dressings applied, just previous to the operation, the parts were again scrubbed and dressings of normal salt solution applied, nothing but normal salt solution was used for the hands and for the sponges after the preliminary preparation had been made.

The operation consisted in first denuding the heel by means of a scalpel of all its scar-tissue. The surface denuded was approximately two and one-half inches in width by three and one-half in length. It was then curetted and particular attention paid to hæmostasis. All bleeding was stopped by means of pressure and torsion and sponges wrung out in hot saline solution. After all the bleeding had been stopped, a dressing of normal salt solution was applied.

The second step of the operation consisted in raising a flap

on the opposite thigh. This flap was about four and one-half inches in length and about three and one-half in width (Fig 1). The outlines of it had been marked on the thigh by means of a silver nitrate pencil and were obtained previous to the operation in the following manner. A sheet of paper was folded snugly over the right thigh (the thigh was selected on account of the thickness of the subcutaneous fat) and the left foot was then brought into position (Fig 2). A flap was then cut in the paper and the heel covered with it. This was repeated several times and the pattern selected which seemed to fit the heel most accurately. The incision was commenced at about the middle of the anterior surface of the thigh, about nine inches below the anterior superior spine of the ileum, and was continued downward and a little outward for a distance of four and one-half inches. Another incision at right angles to the first commenced at its lower end and was directed outward and a little upward for three and one-half inches. These incisions were not straight lines but somewhat curved to fit the corresponding edges of the denuded heel (Fig 1). They were made down to the muscle and the flap included between them was raised. The skin and subcutaneous fat were further undermined to such an extent that the flap, when complete, would correspond to a rectangle of which the two incisions formed the inner and lower sides. Perfect hæmostasis of it and the denuded thigh was also sought and they were compressed for a short time with hot saline solution.

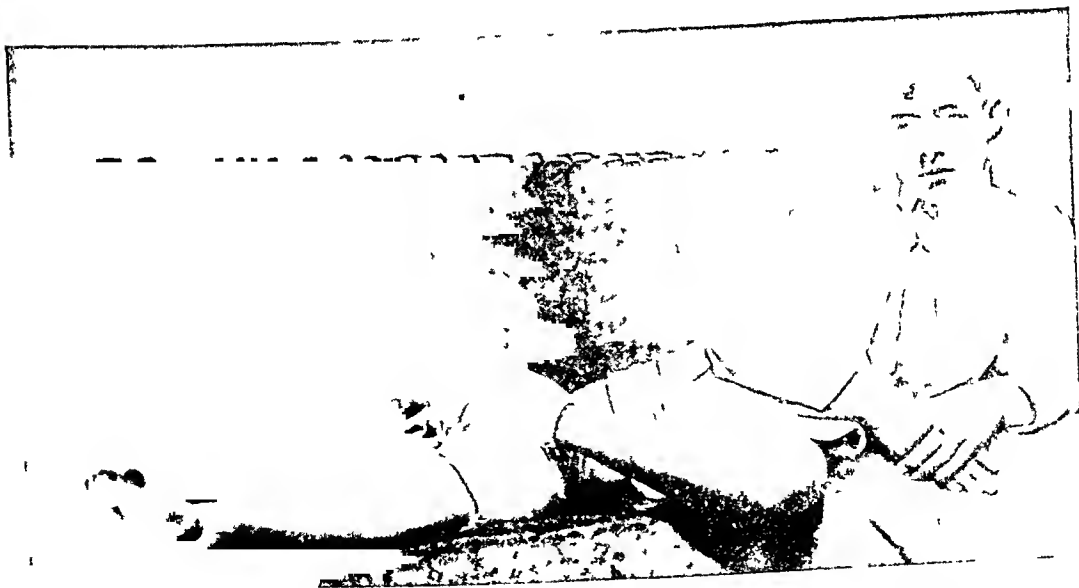
In the third step of the operation, after covering the denuded surface of the thigh with rubber tissue, the parts were brought in position (Fig 2) by flexing the left leg at the knee and applying the foot to the thigh in such a manner, that the denuded surface of the heel would be completely covered by the flap. In this position the corresponding edge of the flap and denuded heel were carefully approximated by means of lead plates and silkworm gut, the left or inner margin of the flap to the upper or right edge of the heel, and the lower margin of the flap to the anterior edge of the heel. When this was done, by slightly moving the foot outward, the flap was made to roll over and hug the heel very closely. At a point a little to the left of what would eventually become its right border, the flap was now sutured by means of lead plates and catgut to the left edge of the denuded heel. After a copious dressing of gauze wrung out in warm saline

FIG 1



Shows the general outlines of the incision and the scar left on the thigh

FIG 2



Shows the position in which the leg was held by the plaster cast. This position was not painful to maintain and there was no special difficulty when the leg was released



Shows the condition of the heel two months after operation The new heel look like a patch that had been pasted on

FIG. 1



A profile shows that the greater part of the foot is covered by scar tissue and that the new heel has considerable thickness It also shows the scar and what remained of the attempt to jump a flap

solution and cotton, the foot was held in position by means of adhesive strips and a plaster cast (Fig 2) The first dressing was allowed to remain in position for six days At the end of this time, owing to the odor, a window was cut in the cast and the parts carefully cleansed and dressed At this time it was noted that the flap looked healthy and had grown firmly to the heel

The fourth and fifth step of the operation consisted in cutting the pedicles with a pair of scissors, the upper one on the seventh day and the lateral one on the ninth day

Remarks—At the time of the first dressing on the sixth day, the flap was firmly adherent to the heel On the ninth day, it was freed from the thigh by cutting its lateral pedicle, because it was thought that a sufficient length of time had elapsed to enable it to get its nourishment from the heel Shortly after this pedicle was cut, it became very congested with venous blood This congestion gradually disappeared about the fourth or fifth day At about the same time it was noticed that a small strip had become gangrenous This strip was about one and one half inches in length and about one half inch in width, and was situated along its outer border The whole thickness of the flap did not become necrotic but only a very small strip about one eighth of an inch in width at its extreme outer edge, where it had not become adherent to the denuded heel This strip was cut away and after the parts had become healthy, an attempt was made to cover it by jumping a flap from the outer aspect of the ankle This procedure was an entire failure The portion of it, which was to cover the heel died, and the remainder was turned back into its original place The scar caused by this operation can be seen in Fig 4 Some time later, when the wound of the thigh where the flap had been removed, was being covered with Thiersch grafts, a few were also placed on this part of the heel to expedite healing The patient was discharged from the hospital May 18, about two months after his admission At that time the heel was entirely covered but the wound of the thigh was only partially healed

The condition of the heel at the present time, almost two

months after the operation is very satisfactory. The patient is an active young man, and has been on his feet a great deal, but as yet there has been no recurrence of the ulcers. The skin is pliable and furnished with a good cushion of fat. Pressure does not cause any pain and he is able to bear his weight on it. The appearance of the heels is quite remarkable. The skin covering it stands out in marked contrast to the other parts of the foot and its borders are very well defined. Fig 3. It still retains its characteristic appearance, being covered with hair and retaining its fat and looking as though it was a patch which had been pasted on the heel. The interesting feature of this case is, of course, the cushion of fat which was furnished in this method of skin grafting and which was about three fourths of an inch in thickness at the time of operation.

The question, of course, arises, will the result be permanent or will the fat atrophy? Can the fat of the heel which is of a fine granular variety with a great deal of connective tissue interspersed, be replaced by ordinary subcutaneous fat from another part of the body? This question, of course, can only be answered after a sufficient length of time has elapsed.

SOME DEFORMITIES OF THE HAND.

BY ELIOT ALDEN, M.D.,

OF LOS ANGELES, CAL.,

Instructor in Surgical Anatomy in the University of Southern California

THE following patients with deformities of the hands seem of sufficient interest to be recorded.

CASE I—*Web Fingers and Other Deformities*—The patient, a man 58 years old, presented himself at my clinic for a callus on the sole of his foot. As the photograph (Fig 1) shows, the fingers of the right hand are short and the webs, especially between the middle and ring fingers, extend farther towards the ends of the fingers than normal. The fingers have the normal number of joints. On the left hand the thumb lacks the terminal phalanx and also the nail. The index and middle fingers are united by a web as far as the base of the nail on the index finger. The webs between the middle and ring, and ring and little fingers are greater than normal. The terminal phalanges of the index and little fingers have slight motion, all the remaining joints are immovable.

The X-ray plate of the right hand (Fig 2) shows remarkable shortening of the middle phalanges of all the fingers, the proximal and distal phalanges being normal. The plate of the left hand (Fig 3) shows but one phalanx in the thumb and an absence of the usual sesamoid bone. The middle phalanx of the index finger is apparently fused with the distal phalanx which is abnormally long and irregular at its base. In the other three fingers the middle phalanx is not represented. In the middle and ring fingers the proximal and distal phalanges are fused together by true bony ankylosis, the trabeculae of bone passing from one bone to the other.

The man has worked as a carpenter and says the disability has been but slight. He has also a cleft of the soft and hard palates and a depression of the upper, left alveolar arch, the latter due to the kick of a horse.

CASE II—*Loss of the Proximal Phalanx of the Index Finger*—The patient was a man, aged 70, who presented himself

for varicose ulcers of the leg Many years ago, "when Garfield was President," he cut his right hand on a circular saw, the index finger being nearly severed His physician wished to amputate the finger but he would not allow it and simply wrapped the finger in a piece of cloth Later the bone protruded from the wound and he returned to the physician and requested him to remove the protruding part This the physician did with a pair of bone cutters The wound eventually healed Further details of treatment and healing are not remembered

The index finger of the right hand is shortened to the level of the second interphalangeal joint of the middle finger (Fig 4) Flexion and extension of the index finger are nearly normal but the range of motion in the terminal joint is somewhat limited The grip between the thumb and forefinger is as great as that between thumb and an equal length of forefinger of the left hand The remaining three fingers and the thumb show Heberden's nodes They are most marked on the thumb and little finger

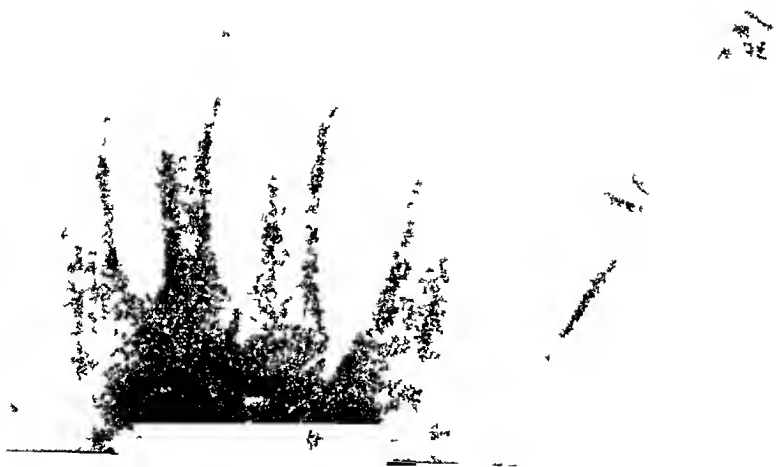
The X-ray plate (Fig 5) shows the absence of the proximal phalanx of the index finger except a small portion of the base Clinically this fragment is ankylosed to the metacarpal bone, the motion taking place in the false joint between the fragment and the middle phalanx This ankylosis is fibrous (Compare with the true bony ankylosis represented in the plates of Case I, Fig 3) The terminal phalanges of other fingers and especially of the thumb show the bony changes of arthritis deformans

The remarkable feature of this case is the adaptation of the muscles to the shortened finger The finger has been shortened about one and a half inches, yet the flexor and extensor muscles have compensated for the slack, and without interfering with the portions controlling the other fingers The perfection of the false joint is also noteworthy That the tendons escaped injury seems improbable yet they were not sutured and seem to have made a perfect recovery

FIG 1



Photograph of Case 1



X ray of Case I right hand

FIG 3



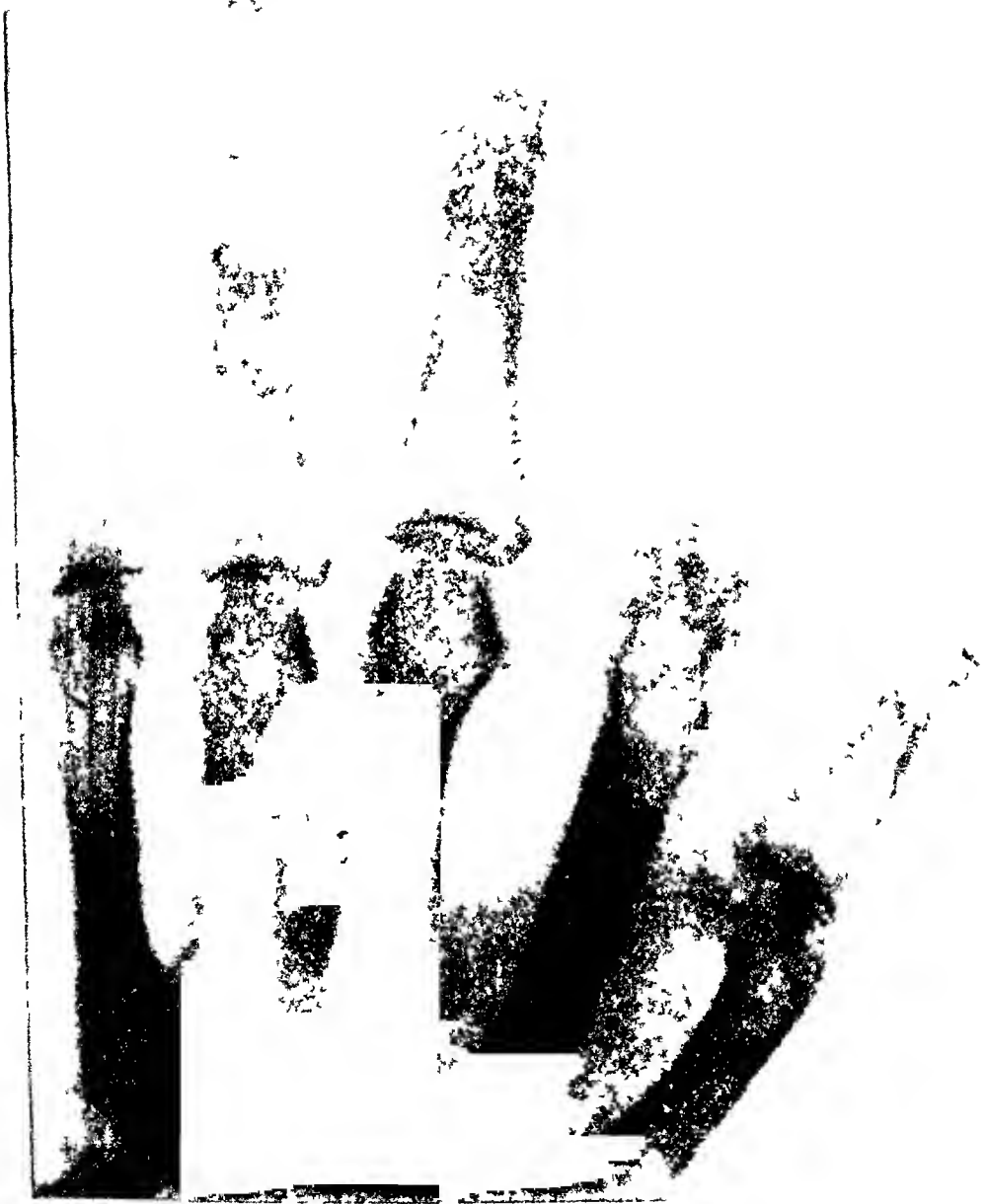
X ray of Case I, left hand

Fig .



Photograph of Case 2 showing loss of proximal phalanx of index finger

FIG 5



X ray of Case II, showing absence of first phalanx of index finger

FRACTURE OF THE OS MAGNUM.

BY ANTHONY HART HARRIGAN, M.D.,

Assistant Surgeon, Out-Patient Department, Harlem Hospital, New York

THE older writers believed, and the statement is still maintained in many standard text books on surgery, that fractures of the carpal bones are very uncommon, and when they do occur are usually compound, comminuted or multiple¹ That this statement is not in conformity with facts, as brought out by X-ray examination, is demonstrated by the increasing number of published case reports of isolated fractures of carpal bones, more particularly the scaphoid and semilunar. Among twenty cases of fracture of carpal bones which came under treatment in the Cologne City Hospital service of Prof Bardenheuer, from 1901-6, only one concerned the os magnum² The relative rarity of fracture of the largest carpal bone adds more than common interest to the following observation, which is reported with the object of calling attention to this hitherto neglected variety of fracture, and of stimulating surgical scrutiny in relation to so-called sprains of the wrist joint

CASE—Male, single, age 33 On August 16, 1908, while cranking an automobile, his hand slipped and the heads of the second and third metacarpal bones of the right hand struck with considerable force the spring, causing forcible flexion at the wrist joint He was seen for the first time in the Surgical Department of Vanderbilt Clinic, No 44,454, on August 18, 1908 He complained of severe pain and swelling of the wrist The examination was made by Dr Alfred C Prentice It was found that the right wrist joint was swollen and hot Tenderness was diffuse over the carpus and motion was markedly limited Acute pain was produced by manipulation An X-ray examination revealed a transverse fracture of the neck of the os magnum Wet dressings and an anterior splint were applied for three days. when the splint was discarded and the wrist joint strapped On September

1, 1908, the adhesive was removed and the patient discharged, as he wished to resume his work as a chauffeur

He was seen for the last time on October 7, 1908. He complained then of an inability to use the hand in efforts requiring strength. For example, he could not "crank" an automobile. Flexion and extension were limited, particularly the latter movement and marked tenderness was obtained by direct pressure over the bone. Distinct bone crepitus was elicited by manipulation of the hand, the palpating fingers being placed over the dorsal and palmar surfaces of the bone.

This outcome must not be regarded as especially unfortunate, since this small fracture, upon the basis of the anatomical relations, has been classed as one of the most serious and difficult to treat among fractures of the radiocarpal region. Moty³ holds that in traumatism of this character, more or less well-marked ankylosis of the two great articulations of the wrist joint must be considered as the natural termination.

A careful and thorough search of the literature reveals but five authentic reported cases, in four of which the diagnosis was based on the clinical signs and symptoms, and in one case only (that of Guernonpiez-Monjaret¹) was radiographic examination employed.

Before discussing these five authentic cases of fracture of the os magnum, reference should be made to several cases described in the literature in which the diagnosis was doubtful, or in which the fracture was associated with multiple fractures of other carpal bones.

The case of Robert,⁵ which is not accessible in the original, is quoted as doubtful by Le Dentu and Delbet.⁶ Duplay and Reclus⁷ refer to the case of a physician who sustained an injury to the wrist which was treated as a sprain. As a limitation of motion at the wrist joint persisted, the patient endeavored to determine the accuracy of the diagnosis by means of the X-ray, the radiograph showed a fracture of the scaphoid, trapezium, trapezoid and os magnum, and that these bones had become welded into one mass by exuberant callus.

FIG 1



Radiography A Upper fragment B Line of fracture C Lower fragment D Obliteration of normal joint line

In a case reported by Guibout, quoted by Auvray,⁸ the os magnum was fractured at the same time as the scaphoid, pyramidal, and pisiform bone. Natrig⁹ reports a case in which the radiograph showed two fractures of the scaphoid, with detachment of the left lower corner of the os magnum.

Destot,¹⁰ in a paper reporting a large number of cases of fracture of the scaphoid, mid-carpal luxations, and fracture of the cuneiform, mentions three cases of fracture of the os magnum, without giving clinical histories and diagnostic criteria. Brigel at the 78th Meeting of German Naturforscher und Aerzte, 1906, mentioned two cases of fracture of the os magnum which came under observation in St. Katherine's Hospital, Stuttgart. Stimson¹¹ describes a case "in which the possibility of fracture was suggested by pain on pressure over the neck of the bone."

The authentic cases arranged in chronological order are as follows:

GUERMONPRÉ¹²—This case, a fracture of the neck of the os magnum, was associated with an extensive synovitis of the flexor tendons, which the author believed was caused by the fragments piercing the synovial sheaths. Immobilization of the wrist was followed by recovery, but a slight increase in the anteroposterior diameter of the wrist joint remained.

BALTUS¹³—This observer, whose case may be included on the authority of Delbecq, reported a fracture of the os magnum, in which the injury occurred in connection with a sudden violent twisting of the wrist joint.

BARDENHEUER¹⁴—The patient was a laborer, sixty years of age, who fell from a scaffold, striking the ulnar side of the dorsum of the hand, and the heads of the third and fourth metacarpal bones. The diagnosis was based upon the exquisite tenderness and subsequent dorsal displacement of the head of the bone.

MORI (1 c) —The patient, a cavalry soldier, was thrown from his horse, striking the dorsal surface of the left hand. When examined soon after the accident, a hard bony protuberance, round and smooth, was found, evidently formed by the radiocarpal articular surface of the carpal bone. This dislocation was easily reduced and the forearm and wrist were immobilized. When examined on the second day, a large swelling was noted on the back of the hand and severe pain elicited over the lateral ligaments of the wrist joint. Crepitus was not obtained, and the styloid processes maintained their normal relationship. This dorsal swelling persisted and at the end of two weeks was still painful and tender, at that time distinct crepitus could be obtained by direct pressure.

GUERMONPREZ-MONJART (1 c) —The patient was a workman whose right hand was caught under a heavy millstone. The most evident symptom was great flattening of the hand and wrist which was followed in two days by a large swelling. The soft parts were intact and no crepitus could be obtained. The hand was immobilized for a few days, followed by massage, and exercises were recommended. Six months after the accident, there was swelling of the wrist, obliteration of the normal anatomical configuration, and muscular atrophy of the forearm and hand. A radiograph taken at that time showed a longitudinal fracture of the os magnum.

In studying the mechanism of this fracture, it is apparent that the injury may be caused either by direct violence over the bone, or indirectly by violence applied to the head of the second, third or fourth metacarpal bone, sufficiently severe to produce forcible flexion at the wrist joint. It is interesting in this connection to note that Auvray (loc cit) succeeded in producing experimental fractures of the carpal bones through direct or indirect violence, the latter being usually accompanied by lesions of the lower extremity of the radius.

In order to explain the manner by which forcible flexion at the wrist joint produces a fracture of the neck of the os magnum, it is necessary to describe the function of the mid-carpal joint as determined by the anatomical peculiarities of that joint. According to Gray,¹⁵ "the chief movements permitted in the transverse or mid-carpal joint are flexion and extension and a slight amount of rotation. In flexion and extension, which are the movements most freely enjoyed, the trapezium and the trapezoid on the radial side and the unciform on the ulnar side glide forward and backward on the scaphoid and cuneiform respectively, while the head of the os magnum and the superior surface of the unciform rotate in the cup-shaped cavity of the scaphoid and semilunar. Flexion at this joint is freer than extension."

Bearing in mind the "rotating" function of the head of the os magnum, it is readily understood that a force acting on the heads of the second, third or fourth metacarpal bones and producing forcible flexion at the wrist joint, is transmitted primarily to the second row of carpal bones and secondarily

to the first row. Therefore, if the posterior radiocarpal ligament be weak, a posterior dislocation of the wrist joint results. However, if this ligament be relatively strong and resistant, the strain during the transmission of force falls upon the weakest part of the relatively immobile os magnum—the neck—and a fracture ensues. That this reasoning is true, is proved by the anatomy of the mid-carpal joint and by the clinical study of the case of Bardenheuer and the one reported by the writer.

Symptoms—The symptoms of fracture of the os magnum may be summarized as follows. An individual who receives a direct injury to the bone, or who strikes the heads of the second, third or fourth metacarpal bones violently enough to produce forcible flexion at the wrist joint, will complain of severe pain over the carpus and inability to use the hand. The pain is diffuse and may radiate to the fingers, following the course of the median nerve, it may be exacerbated locally by deep pressure. Crepitus at a distinct point of the region is of course pathognomic, but may be marked by extensive swelling of the wrist. This swelling, which is the result of extravasation, promptly makes its appearance (see author's case) and is chiefly confined to the dorsum. The maximum point of tenderness is over the os magnum, and from an analysis of the reported cases, this appears to be the most characteristic symptom. If there be an associated dislocation of the head of the bone, a hard protuberance can be detected on the dorsum of the hand. A radiographic examination will serve to confirm the diagnosis.

The *treatment* of simple fractures, uncomplicated by synovitis, consists in absolute immobilization of the hand, wrist and forearm, followed by massage. Complicated fractures require antiphlogistic treatment and immobilization until subsidence of the inflammatory symptoms. Articular stiffening and loss of functional power should be treated by active and passive motion, electricity, massage, and hydrotherap,

CONCLUSIONS

1 Fracture of the neck of the os magnum may be caused by direct or indirect violence

2 The most characteristic symptom is a localized point of exquisite tenderness over the neck of the bone

3 All severe sprains of the wrist joint should be subjected to X-ray examination

In conclusion, the author wishes to thank Dr Adrian V Lambert, Chief of the Surgical Department, Vanderbilt Clinic, and Dr Alfred C Pientice, for the privilege of reporting this case

BIBLIOGRAPHY

- ¹ Tillmanns, Text-book of Surgery, III, 1901
- ² Glasmacher, Inaugural Dissertation, Leipzig, 1906
- ³ Moty, Gazette des Hôpitaux, No 69, 1890
- ⁴ Guernonprez-Monjaret, Jrl d Sciences Med de Lille, VIII, 1904
- ⁵ Robert, Annal de Therap de Rognetta, 1845
- ⁶ Le Dentu and Delbet, Traite de Chirurgie
- ⁷ Duplay and Reclus, Traite de Chirurgie, T 2, 1897
- ⁸ Auvray, Gazette des Hôpitaux, No 4, 1898
- ⁹ Natrig, Tidsskrift f d Norske Laegeforening, 1901
- ¹⁰ Destot, Verhdlg d dtsch Rontgen Ges, 1, 1905
- ¹¹ Stimson, Fractures and Dislocations, 1907
- ¹² Guernonpre, Soc de Chir, Nov 23, 1882
- ¹³ Baltus, Quoted by Delbecq, These de Paris, 1888
- ¹⁴ Bardenheuer, Dtsch Chirurgie, Lfrg 63 b, 1888
- ¹⁵ Gray, Anatomy, Descriptive and Surgical, 1897

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, October 14, 1908

The President, DR JOSEPH A BLAKE, in the Chair

CHOLANGEITIS DUE TO COLON BACILLUS INFECTION

DR JOHN A HARTWELL presented a woman, 39 years old, who was admitted to Bellevue Hospital on September 10, 1908. She gave a marked alcoholic history, and on admission was found to be suffering from acute alcoholism, as a result of which she had a severe gastritis. It was learned that for a month previous she had been vomiting more or less frequently and had suffered from pain in the epigastrium after eating, which was somewhat relieved by the vomiting. Her condition had grown progressively worse, and on one or two occasions she had vomited blood and had passed blood per rectum. All these symptoms were at first referred to her alcoholic history. An examination, however, revealed a large, tender mass beneath the right costal margin, and apparently closely connected with the liver, which itself was much enlarged. She complained of intense pain, rather diffuse, over the right hypochondrium and extending through into the back. Her fever was of the septic type, she looked sick, and had a leucocytosis of 23,600, with 82 per cent polynuclears. The urine was normal. She was not jaundiced.

The case was regarded as one of cholecystitis, and the patient was operated on September 14, 1908, under gas and ether anæsthesia. The abdomen then became less rigid, and the mass referred to above was found to be the liver itself. An incision was made through the upper half of the right rectus muscle, and upon opening the peritoneum the liver was found to extend almost to the umbilicus, being apparently uniformly enlarged in all direc-

tions It was soft, dusky in color, but no area of actually broken-down tissue could be found It was not jaundiced An exploration of the gall-bladder and ducts showed them to be patent, and no calculi were found The gall-bladder, however, seemed somewhat thickened and inflamed The stomach, pylorus and duodenum were found to be normal, and there was an absence of adhesions around any of them Owing to the intense pain in the back, and the absence of positive findings connected with the biliary system, the lesser peritoneal cavity was explored through the gastrohepatic omentum The peritoneal sac was found free from adhesions, but the pancreas was enlarged to one and one-half its normal size, and rather soft, with its blood-vessels distended to a marked degree The condition of the organ suggested the possibility of an abscess in its head, and accordingly an incision was made into this, parallel with the ducts A free hemorrhage resulted, but no pus nor broken down tissue was found The case was therefore deemed one of infectious cholangitis

The gall-bladder was stitched to the parietal peritoneum and drained externally through a tube Its contained bile was thick and turbid A cigarette drain was inserted into the incision in the pancreas, and the abdominal wound was closed in the usual manner The patient bore the operation well, and left the table in good condition The post-operative course was satisfactory, the temperature, pulse and blood findings gradually returning to the normal There was a free drainage of bile through the tube, the bile becoming clear during the first day The abdominal pain had entirely disappeared by the third day, and the liver was progressively growing smaller The tube was removed from the gall-bladder on October 1, up to which time the drainage of bile had been copious On that day the liver percussed about two inches below the free margin of the ribs, and could be felt At the present time the drainage of bile has entirely ceased, and the liver is barely palpable below the free margin of the ribs The patient is entirely free from pain and distress of any sort, and her digestion is excellent Cultures from the bile drained from the gall-bladder at the time of operation showed a pure growth of colon bacillus Examinations of the urine at no time showed any evidence of pancreatic involvement, the Cammidge test being absent on September 17 (Dr Hastings) and again a week later (Dr Meakin)

GONOCOCCUS PERITONITIS

DR HARTWELL presented a woman, 27 years old, who was admitted to the Presbyterian Hospital on September 18, 1908, in the service of Dr Woolsey. Her family and personal history was negative up to the time of the birth of her child, one year previously, since then she had suffered from a vaginal discharge. For the past three months she had not felt as strong as previously, but no special symptoms were noted. On September 15 she was suddenly seized with a severe, cramp-like pain in the lower abdomen, slightly more marked on the left side, with a tendency to radiate over the entire cavity. On that and the following day she had severe diarrhoea, followed by obstinate constipation. She had repeated slight chills and an apparent rise in temperature at various times. She had vomited but once, and that on the day of admission.

The general appearance of the patient was that of a person suffering from intra-abdominal inflammation. There was no evidence of any disease outside of the peritoneal cavity. The abdomen was symmetrically distended, the distention being more marked in the lower half, but without difference on the two sides. It was tympanitic and tender to pressure, but no particular point of tenderness could be made out. No mass could be felt in the region of the appendix. Vaginal examination showed fulness and tenderness in the fornices, but no masses were felt. Temperature, on admission, 101, pulse, 120, respirations, 22; leucocytosis, 22,800; polynuclear count 81 per cent.

A diagnosis of spreading peritonitis was made, without determination of the site of the infection. One hour after admission, under gas and ether anaesthesia, a two-inch incision was made over the outer border of the rectus muscle, and upon opening the peritoneal cavity there was an escape of cloudy serum, without odor, which did not seem to be walled off. The appendix was exposed, drawn into the wound, and removed in the usual manner. It was slightly inflamed externally, but showed an entire absence of any lesion which could be held responsible for the peritonitis. The incision was slightly enlarged downward, and an exploration of the pelvic organs showed them to be normal excepting for the inflammation due to the peritonitis. The maximum degree of peritonitis, however, seemed to centre in the lower part of the

abdomen The intestines were drawn out from this part with a view of finding a cause for the peritonitis in a perforation or volvulus Nothing of this nature was found, however, and it was apparent that the peritonitis was general in character The wound was enlarged upward, and a systematic search made of the whole intestinal tract, stomach, bile passages and pancreas without finding any entrance of infection The gut was uniformly distended and covered in many places with plaques of fibrin The exploration had entailed an extensive handling of the gut, and it was thought that a fatal paresis would result unless the gut was emptied of its toxic contents Accordingly, the procedure recently advised by Monks and others, of irrigating through and through the bowel was decided upon, though a modified technic was used An irrigating tube was inserted into the bowel just below the duodenum, and the second one just above the cæcum Large quantities of warm saline solution were washed through the whole of the small intestine, evacuating a very considerable quantity of intestinal contents, which from its appearance, must be considered as excessively toxic This procedure, however, is by no means an easy one, as the intestines have a marked tendency to angulation, resulting in a stoppage of a continuous flow for a distance of more than two or three feet This necessitates a milking of the irrigating fluid from one end to the other, and a very considerable handling of the intestine, which is known to be disastrous in peritoneal inflammation Whether the damage thus entailed was more than counter-balanced by the elimination of the toxic material, may be a question The favorable outcome in this case seems to have justified it The stomach was also washed out After a thorough flushing of the peritoneal cavity, the abdominal wound was sutured without drainage An intravenous infusion of salt solution was deemed advisable at the end of the operation

Postoperative Course —The patient was placed in the Fowler position Nothing was given by the mouth, and turpentine stupes were applied to the abdomen The convalescence was slow, but uninterrupted toward recovery Gonococci were found in the smears from the peritoneal fluid, with no other organism, and cultures on blood serum developed no growth Gonococci were found in abundance in vaginal smears On the third day after operation the patient received injections of gonococcus vaccine,

and the vaginal infection was treated locally. Whether the vaccine had any favorable effect on the course of the peritoneal infection is impossible to say. Had a microscopical examination of the peritoneal fluid been made immediately on opening the abdominal cavity, a diagnosis would have at once been established, and the exploration in search of the site of infection would have thus been avoided. Such an examination seems to be the proper course in similar cases.

PERFORATED GASTRIC ULCER

DR. HARTWELL presented a man, 48 years old, who was admitted to Bellevue Hospital on September 2, 1908. A year ago he had an attack of abdominal pain, with nausea and vomiting, which was of short duration. Aside from this, his digestion had always been good. There was a history of syphilitic infection six years ago, for which he was under treatment for five months.

On the day of his admission, the patient had been eating a great many apples, and while on the street he was suddenly seized with intense pain in the abdomen. The pain gradually increased in severity and was accompanied by marked nausea, but no vomiting. According to his own statement, he was in a profuse cold sweat. He was brought to the hospital in an ambulance, and while on the trip vomited several times with some relief from the pain, but he felt so weak that he could scarcely move.

On admission to the hospital, the patient seemed to be in a state of collapse. He was suffering intense pain, and presented the typical facies of peritoneal infection. The abdomen was somewhat distended, tense and generally tender, although the maximum point of tenderness seemed to be in the epigastric region. Rigidity was about equal in the two recti muscles, and no masses could be felt. A diagnosis of peritonitis was made, with the probable site of infection in the upper right quadrant, though the appendix could not be excluded. The leucocyte count was 18,000, with 79 per cent polynuclears. There was slight elevation of pulse and temperature.

The patient was operated on two hours after admission. An incision was made through the right rectus at the level of the umbilicus. Free pus (not foul) was found in the peritoneal cavity, this was particularly localized in the right fossa. The appendix was found to be slightly adherent and kinked, but not

actively inflamed or perforated. Appendectomy done. Pus was found under the liver. The gall passages were normal. The ileum was explored and no perforation found. The region of the pylorus was explored, showing evidences of a fresh peritonitis and pus. The stomach was dilated. The transverse mesocolon was opened and the lesser peritoneal cavity and posterior wall of the stomach were apparently normal. There was no induration in the pancreas, but an indurated area was found on the anterior superior surface of the stomach, one inch from the pylorus. The stomach and pylorus were angulated, due to adhesions. In the centre of the indurated area was a pin-hole perforation, which was closed by overlapping the stomach wall with silk sutures. The pylorus was apparently patent, gastro-enterostomy, therefore, was not done, owing to the patient's condition and the time already consumed in the operation. The ulcer and perforation above described were found only on a second examination of the pyloric region, they having been at first mistaken for the result of the peritonitis, and not the cause of it. The abdominal wound was closed in layers, and a drain was placed at the site of the ulcer.

The postoperative course was satisfactory and progressive toward recovery. The patient was fed by mouth on the third day, and within ten days was taking full hospital diet with absolutely no discomfort. He had now been up and about the wards for about two weeks, and showed no evidence whatever of any gastric lesion. Gastric analysis at the present time showed a marked hyperacidity.

Dr. Hartwell said this case was shown with the hope of bringing out a discussion on the subject of performing a gastro-enterostomy in cases of acute perforation of gastric ulcer, either primarily or secondarily.

Dr. Ellsworth Eliot, Jr., said that this question of whether or not to do a primary or secondary gastro-enterostomy after operation for acute perforation of the stomach had been very fully discussed at one of the meetings of the Society last spring. At that time, the speaker said, he had prepared a paper on the subject of acute perforative ulcer of the stomach and duodenum, with particular reference to the advisability of doing a gastro-enterostomy, either simultaneously or later on. That paper was published in the October and November (1908) issues of the *AMERICAN JOURNAL OF SURGERY*. It contained the result of the

author's investigations, covering the reports of several hundreds of cases published in the literature during the past five years, and supplemented by additional reports furnished by members of the American Surgical Association and others. Altogether, during that period, about one hundred cases were found where a gastro-enterostomy had been done at the time of the primary operation, and in these cases the mortality was high—at least fifteen or twenty per cent, whereas in those cases where the perforation was closed without gastro-enterostomy, the mortality was considerably lower.

A study of the cases also showed that in a very considerable number of them, in fact, in the great majority in which simple closure of the perforation was done without gastro-enterostomy either at the time of the primary operation or subsequently, the patients remained well for periods varying from one to five years; in one instance for six years.

In view of these facts, Dr. Eliot said, it seemed proper to postpone gastro-enterostomy until the patient should develop obstructive symptoms or show some other reason for further operation. His own feeling was that the operation of gastro-enterostomy was indicated at the time of the primary operation in those cases where closure of the ulcer caused mechanical obstruction, but that it should not be undertaken for the purpose of obviating the possible future occurrence of stenosis, ulcer or hemorrhage, or other protracted symptom inscribed with that condition.

HYPERTROPHIC PYLORIC STENOSIS

DR LUCIUS W. HOTCHKISS presented a man, 32 years old, upon whom he had operated for pyloric obstruction at Roosevelt Hospital on July 28, 1908. The patient, who was admitted to the hospital on July 24, had been the subject of considerable study elsewhere, and was thought first to be a case of simple gastric dilatation, but as his condition failed to improve under treatment, he was brought to the hospital for operation by Dr. Howard C. Hanscom, who had made the diagnosis of pyloric obstruction. His illness dated back one year, when his appetite became capricious. Two months ago he began to vomit, this occurring generally after supper, sometimes within half an hour, sometimes after several hours. The vomiting was preceded by nausea, but no pain, and was followed by relief. The vomitus

consisted of undigested food, and did not taste sour nor bitter, and, according to the patient's statement, it never contained food which had been taken a considerable time before. He had been constipated for the past year, and had lost, he thought, about eighteen pounds in weight.

His previous history was unimportant, excepting for the fact that he had had syphilis about six years before, with a rash and mucous patches, and moderate alopecia. He was treated by mercury for two years, and had shown no outward manifestations of the disease since. Four years ago he had had a "nervous breakdown," and was in a sanitarium for seven months. He had been unable to work for a year and a half, and his responses as to his symptoms and condition were given slowly and with apparent effort, so that it was very difficult to obtain from him a complete and satisfactory history.

Physical examination revealed a small, rounded mass, of firm consistency, in the region of the pylorus, this was felt on deep pressure in the subcostal angle, just to the right of the median line. It was movable laterally and vertically, and seemed also to move with respiration. It was not tender and sometimes it was not demonstrable. The patient was thin and sallow, and appeared to be somewhat feeble. He showed no glandular enlargements, his heart and lungs were normal, no knee-jerks could be elicited.

An analysis of the gastric contents showed free hydrochloric acid, 10, total acidity, 73, combined, 33, lactic acid, absent, starch digestion poor.

The patient was put to bed, saline enemata were ordered, and a soft, selected diet allowed. Under this regimen his strength seemed to improve, and he was prepared for operation, which was done on July 28, four days after admission. Through the usual incision above the umbilicus the stomach was found to be moderately dilated and loosely surrounded by the lesser omentum. The pylorus and first part of the duodenum were freely movable. The pylorus was thickened by a fairly uniform infiltration of its coats, though this was perhaps slightly more marked posteriorly, where there was a small patch of connective tissue in the peritoneal covering. This thickening of the walls of the pylorus, which was due either to hypertrophy or infiltration of the muscular coat, constituted the tumor felt, and had led to the contraction of the

opening into the duodenum to about the size of a lead pencil. On section, there was no ulcer of the mucosa found, and the contracted pyloric opening was practically concentric with its outer circumference. The pathologist reported the condition as "inflammatory," and upon search no *spirochætæ pallida* were found, nor were any evidences of endarteritis or phlebitis of the vessels in the affected region noted. There was moderate soft enlargement of the glands along the pyloric portion of the greater curvature, but section showed nothing of a malignant or specific nature.

The pylorus was excised in the usual manner, and the ends of the duodenum and stomach were closed by sutures. A posterior gastro-enterostomy without a loop was then done, after the method of Mayo, and the abdominal wound was closed.

The after-course of the case was without incident and the wound healed promptly. The patient was allowed water by the mouth on the day after the operation, but was otherwise nourished by small saline enemas containing half an ounce of dextrose. On the second day, albumin water was given by the mouth every two hours, and on the sixth day fluids without milk were given in four-ounce quantities every four hours. On August 6, nine days after the operation, soft boiled eggs and scraped beef sandwich were allowed, and a soft selected diet was given after that date. The patient rapidly regained his strength, and his digestion is now excellent. He was discharged from the hospital on August 15, and since then had gained 34 pounds in weight.

This case, Dr. Hotchkiss said, had seemed rather remarkable in its pathology, and had led to considerable discussion as to the possibility of its being a syphilitic stenosis on account of the patient's antecedent history, although the histological examination failed to furnish conclusive proofs.

RENAL CALCULUS

ALEXANDER B. JOHNSON presented a man, 39 years old, who for the past fifteen years had suffered from attacks of pain in the right lumbar region, radiating downward into the right testis. These attacks were very severe, and lasted about ten minutes. During the past year they had increased in frequency, so that a number of attacks had occurred each day, and had become more severe. He had never noticed anything peculiar about his urine, and otherwise his health was fairly good. A year ago an X-ray

picture of good quality showed no shadow of a stone. His urine at that time had been reported free from any abnormal ingredient. A second X-ray picture was taken at that time, and was also negative. The patient thereupon decided to have no operation done unless his symptoms grew worse.

He re-entered the hospital on September 11, 1908, with the history that the attacks of pain had become more and more annoying, and that he had lost some flesh. His urine at that time contained a few blood-cells visible under the microscope. He was operated on September 17, 1908, by Dr. Johnson. An incision was made below and parallel to the free border of the ribs, extending from the outer border of the rectus in front to the outer border of the erector spinæ behind. The kidney was exposed, freed from its fatty capsule, and drawn into the wound so that its pedicle could be firmly held by the fingers as the kidney rested in the palm of the left hand. Dr. Johnson was unable to feel the stone on palpation of the hilum and pelvis. There was nothing abnormal about the appearance of the kidney. A hat-pin introduced through the convex border of the kidney into the pelvis at once touched a stone, and an incision an inch and a half in length was made along the middle of the convex border of the kidney into the pelvis, and a forceps inserted through the cut withdrew a somewhat heart-shaped stone weighing 40 grains. It consisted chiefly of uric acid, as might be inferred from the fact that although the patient was a slender man, and the X-ray negatives were satisfactory, the stone cast no perceptible shadow.

Dr. Johnson said he attached great importance to the complete delivery of the kidney, so that the pedicle could be compressed between the fingers while the kidney was incised, thus avoiding the troublesome hemorrhage which often occurred unless this was done. He said that the study of corrosion preparations of the blood-vessels of the kidney showed that while in the cortex of the organ, along the central portion of the middle of its convex border there were but few blood-vessels of any size, such was not the case at the bases of the pyramids, where vessels passed freely from side to side.

The kidney wound was sutured by two deeply placed mattress sutures of fine chromic gut, and a cigarette drain was inserted down to the wound of the kidney and brought out at the posterior angle of the external wound. The remainder of the wound in the abdominal wall was closed by sutures. Although the wound

remained entirely clean, and showed no evidences of urinary leakage, and although the patient continued to pass plenty of urine, which was normal in character except for a moderate amount of blood, some anxiety was caused by the fact that the patient ran a high temperature and was delirious for a week. The temperature did not reach normal until twelve days after the operation. Primary union occurred in the wound, excepting at the drainage opening. The patient left the hospital well twenty days after the operation, namely, on October 7, one week ago, and thus far had had no further discomfort.

RESULT OF OPERATION FOR UNDESCENDED TESTIS

DR JOHNSON presented a boy, twelve years old, whose right testis had never descended into the scrotum, otherwise he was a healthy child. There was a history of the occasional appearance of a tender mass in the inguinal canal. The operation was done about two months ago. An incision was made along the course of the inguinal canal. The external oblique aponeurosis was split as in Bassini's operation, and inspection showed the presence of a congenital hernial sac to which were adherent the structures of the cord, with the exception of the testis. The testis itself was but loosely connected with the epididymis, and lay within the abdominal cavity. The hernial sac was dissected away from the cord and sutured with a purse-string suture at the level of the internal ring. Bassini's operation was then done, the cord was pulled out of the inguinal canal with some force and sutured to the pillars of the external abdominal ring. The scrotum was then inverted and the testis sutured with catgut to its most dependent point. A very slight inflammatory reaction followed the operation, and the testis became slightly swollen, though not notably tender nor painful. Primary union occurred in the wound. At the present time, two months after the operation, the testis had increased in size, it lay well down in the scrotum, and there seemed to be no tendency toward a recurrence.

PERITONITIS IN CHILDREN WITH UNKNOWN SITE OF INFECTION

DR CHARLES N DOWD read a paper with the above title, for which see page 821.

DR HOTCHKISS said he had seen four or five cases of generalized peritonitis, all in adults, for which there was no assignable

cause He could not speak of these cases in detail, as no cultures had been made One of the cases recovered after a secondary opening, with irrigation of the abdominal cavity. The patient was a woman with a diffuse general peritonitis without visible cause, even after a very thorough exploration of the abdominal cavity The cavity was irrigated, but the patient did very badly Her condition was so desperate that as a forlorn hope the house surgeon removed the sutures two or three days later, introduced a tube, and again irrigated the abdominal cavity Following this she made a good recovery

DR ELIOT said he had never seen cases in children like those described by Dr Dowd The cases he had had experience with were more like those referred to by Dr Hotchkiss The speaker said he had seen four or five cases of streptococcus peritonitis in adults, with recovery after an illness of four or five weeks, with continuous high temperature (104-5) and a corresponding pulse rate Subsequently, the temperature fell by lysis These patients were delirious most of the time The stomach, as a rule, held out well In one of the cases, a woman, where he was called upon to do an operation for ventral hernia two years after the peritonitis which originated in the pelvis, a careful exposure and exploration of the organs there situated revealed nothing abnormal

Dr Eliot said that in one case of general peritonitis in a young man of 25, the patient presented all the physical signs of a gastric perforation Upon opening the abdomen, the small intestine was found enormously distended, but no definite cause for the peritonitis could be discovered The patient recovered and returned in the course of six or eight weeks with a second attack of peritonitis from which he also after operation recovered At the second operation, many adhesions were found, but no cause for the peritonitis could be discovered

The speaker said that while we saw many cases of peritonitis in children, it was usually of the appendix type and of colon bacillus origin The extensive blood counts made in connection with these cases were interesting, in that they indicated a severe grade of infection, and particularly for the reason that in this group of cases diarrhoea is the rule, whereas in other serious forms of spreading or general peritonitis diarrhoea is the exception The presence of diarrhoea in peritonitis usually indicates a favorable

prognosis It is surely of great importance to emphasize the fact that, in the peritonitis of children, diarrhoea should not in any way be favorably continued nor should it lead to delay in operation

DR JOHN F. ERDMANN said he had seen two of the cases in all probability reported by Dr Kerley One of the cases was an infant about eight months old, who was practically moribund at the time of operation The abdominal cavity was filled with purulent material Nothing was found in the region of the appendix or elsewhere to account for the infection The case resulted fatally In another case, a girl of eight or nine years old, with scarlet fever and otitis, there was a general streptococcus infection complicated with middle-ear trouble This patient was also moribund, and Dr Erdmann said he refused to operate In a third case, seen in Hackensack with Dr Edgar K. Conrad, the patient was a child two and a half years old who gave a history of diarrhoea similar to that in the cases reported by Dr. Dowd There was distinct abdominal distention, and upon opening the abdomen, at least half a pint of pus was evacuated The appendix was removed, although not dire and to the extent one would expect in such a purulent peritonitis The child made a slow recovery

DR JOHN B WALKER said he had seen two cases of peritonitis in children in which the infection was of unknown origin One was in a child of five years, the other in a child of seven One recovered and one died

DR JOSEPH A BLAKE said he had operated on several cases of peritonitis in which he was unable to find the source of the infection. The patients died, and no bacterial examinations were made He recalled several cases in children where the infection was traced to the Fallopian tube, and those in whom the tube was removed got well, while those in whom it was allowed to remain, died In one or two of the cases, a little pus could be expressed from the tube Possibly, some of these were of gonorrhœal origin.

In connection with this general subject, Dr Blake said he had had the misfortune of operating on two cases, both adults, in which the peritonitis complicated an unrecognized pneumonia In both there was free peritonitis, with marked injection of the peritoneum with serum and fibrin below the diaphragm, but no other discover-

able site of infection Both cases recovered The possibility of a peritonitis associated with an intrathoracic infection should not be lost sight of

Dr Dowd, in closing, said that the blood examination in these cases showed a high leucocytosis and a high polynuclear count The difficulty in diagnosis in children was partly due to the fact that abdominal inflammations were so often simply accompaniments of inflammations which were primary in other parts of the body In the early stages of the inflammation there is less abdominal rigidity than frequently exists with a beginning pneumonia The cases here recorded had been under the observation of very careful observers and early diagnosis had not been made

BOOK REVIEWS.

THE PRINCIPLES AND PRACTICE OF MODERN SURGERY By
ROSWELL PARK, A.M, M.D, LL.D (Yale Lea Brothers
& Co, 1907.)

THE author states that it has been his purpose in writing this book "to represent the surgery of to-day, obsolete, and obsolescent material having been excluded" A treatise on surgery written with such an object in view, presupposes selective ability and discrimination on the part of the author, for, while it is easy enough to decide on what is obsolete, it is not so easy to say whether an operation has merely become temporarily unfashionable or really out of date There are fashions in surgery, as well as in millinery; and it is not always easy to foretell the permanent in surgery. There is certainly no one in the profession, however, better fitted to pass judgment on matters concerning the practice of surgery than Dr Park. Long known as a brilliant and effective teacher, we naturally expect from him a work which will fulfil his purpose, and the expectation of the medical public

This volume of one thousand pages is not too bulky to be easily handled While it is a good deal more than an epitome, it is also far too thorough in its treatment of the various subjects to be called a hand book. To speak surgically, it contains no dead spaces, and the author is to be congratulated on the skill with which he has compressed so much that is of value into space relatively small.

No subject has been treated in a manner merely sketchy, and both student and practitioner will find each chapter a complete treatise, although condensed Dr Park's illustrations may be sometimes outlines, his text never The writer well describes his method in the following brief but pithy sentence: "The surgeon and the physician have drifted too far apart It is time they met again in the presence of the pathologist Such a group, when properly constituted, forms an almost invincible triumvirate" These sentences may be commended to those rash individuals who

enter the practice of surgery as a specialty, with little or no experience and knowledge in surgical pathology and without some years of training first in general medicine. We ought to remember that the really great men in either medicine or surgery have, first of all, been pathologists. The path to real greatness in medicine and surgery passes through the dead house. For, unless a man has a thorough knowledge of morbid tissues and what may be called the mechanics and physics of disease, he can never become an accomplished diagnostician. Without such a foundation, natural aptitude and nerve may make a man an operator, but a man may be a good operator, and yet a very mediocre surgeon. Dr. Park might have gone further, and have said that a really good surgeon must himself be a sort of trinity—physician, pathologist, surgeon.

To particularize concerning this interesting volume, the five chapters of Part I are devoted to surgical pathology. The chapter on the surgical pathology of the blood contains all that is essential to a thorough understanding of the subject, both new and old. Part II treats of surgical diseases, including affections which are commonly called specific. There is an excellent chapter also on *The Status Lymphaticus*—a condition even now too little understood, and often overlooked entirely. Part III treats of surgical principles, methods and minor procedures and contains an interesting chapter on blood pressure, shock and collapse, anæsthesia and anæsthetics. Part IV treats of injury and repair and contains an excellent chapter on gunshot wounds, also a chapter on Asepsis and Antisepsis. Part V concerns surgical affections of the tissue and tissue system. There is a chapter on Cysts and Tumors, on Surgical Diseases of the Heart and Vascular System, Surgical Diseases of the Joints, Chapters on Fractures and Dislocations. Part VI treats of Special or Regional Surgery and contains a very complete record of the modern surgery of the abdomen, kidneys, bladder, and prostate, also all parts above the diaphragm. The half-tone plates (of which there are a large number) are singularly clear and free from blurring, in fact, they have all the distinctiveness of an original photograph. The sixty colored plates are of equal excellence. The publishers have done well by the author, and the book will, no doubt, receive the cordial commendation of the profession.

ALGERNON T. BRISTOW

SURGERY. By JOHN ALLAN WYETH, M D, LL D (University of Alabama) With 864 illustrations Marion Sims Wyeth & Company, Publishers New York City, 1908

The first edition of this standard work appeared in 1887 and immediately took high rank among similar treatises. It was especially noteworthy, because of the author's valuable contribution to the surgery of the arteries. Indeed, nine years before this his prize essay on the arteries had been presented to the American Medical Association, and attracted much attention, both in this country and abroad. Dr Wyeth was the first surgeon to point out the advantage of ligating the external instead of the common carotid, and his treatise on the subject has long been known as a classic. It was noteworthy for painstaking research, both in the pages of current literature and for much original work on the cadaver. The same care in regard to detail which won for the author his first laurels, he has bestowed on his treatise on surgery. Three editions were published by the Appletons—the last in 1900, but now we are presented with an entirely new work from the presses of a new publishing house. Marion Sims Wyeth & Co. come before the public with this their first book, a treatise on Surgery, by John Allan Wyeth. That the new house may publish many good books, and flourish exceedingly, will be the heartfelt wish of those of us who were fortunate enough to have known the grandfather, Marion Sims, that ornament of American Medicine, and the father, Dr John A. Wyeth, ex-president of the American Medical Association, now President of the New York Academy of Medicine. Truly the young publisher has a great heritage in his ancestors. That he will publish many a worthy volume, we feel certain, but it will be a long time before he has a chance to better his first publication. Both father and son—author and publisher—are to be congratulated on the happy combination of circumstances which links them together in a new and pleasant relationship. The typography and illustrations of the new book are very creditable, the work is copiously illustrated, both with half-tone plates and plates in color. Nor have older methods of illustration been neglected. Whatever may be said of the beauty of the best half-tones which come from our modern presses, the camera can never entirely replace the burin of the engraver for teaching purposes.

Dr Wyeth has succeeded in compressing into a volume of

less than 800 pages all the essentials of modern surgery and a great many of its refinements. Under the head of anæsthetics, Gwathmey's warm vapor apparatus receives mention, also Brown's mechanism for combined heated nitrous oxide and oxygen. Reference is also made to the enlarged scope of local infiltration anæsthesia as practiced by the author and Dr Bodine at the New York Polyclinic. In the chapter on arteries, Matas endoaneurismorrhaphy is fully described. The author also refers to his own case of aneurism of the ascending aorta, in which he employed simultaneous ligation of the right carotid and subclavian arteries with success, the patient surviving for a year—dying after that interval of another disease. As an example of the possibilities of cocaine, the author states that he has tied the third division of the subclavian by the aid of this anæsthetic. The chapters on fractures and dislocations, while not exhaustive of course, are sufficient, and clearly illustrated. In the chapter on the surgery of the head, modern methods of attack on the cranial contents are fully described and well illustrated, and Cushing's operation for decompression receives particular mention. Under the head of trigeminal neuralgia, the recent procedure of Levy and Baudoin (in which alcohol injections into the affected nerves are used), are fully described. The chapter on abdominal surgery contains a concise description of all the modern methods, as elaborated by Moynihan, the Mayos and others. The half-tone plates in this chapter will be exceedingly useful to the operator who is new to these methods. The modern surgery of the prostate gland—particularly Young's operation—is carefully described. The chapter on the genito-urinary organs of the female contains an excellent description of plastic operations on the outlet, and an account of the methods of the late colleague of the author, Dr Pryor, in attacking diseased appendages through the vaginal route, in which he was so successful. The chapters on neoplasms and the surgical infections, while relatively brief, as might be expected in a work limited to less than 1000 pages, nevertheless contain the main facts. Dr Wyeth is to be congratulated upon his ability to compress so much in so small a space. He has written an admirable text-book for the student, a compendium for the general practitioner, and a volume which his colleagues and co-workers in surgery will often consult with profit.

ALGERNON THOMAS BRISTOW

DIE OPERATIONEN BEI MITTELOHREITERUNGEN UND IHREN IN-
TRAKRANIELLEN KOMPLIKATIONEN. Für Aerzte und Stu-
dierende von DR. B. HEINE. 8vo, pp. 197. S Karger, Ber-
lin, 1906.

This is altogether a very satisfactory work, which will well repay the aurist to read in the original. To some of its teachings brief reference will be made. Thus: in middle ear inflammation, paracentesis is indicated if bulging exists, accompanied by fever and severe pain. Inflation is contraindicated in acutely inflamed ears. Paracentesis is also indicated when mastoid tenderness or swelling of the soft parts already exists. This applies more forcibly when symptoms of meningeal irritation appear.

Chapter 3 is devoted to the discussion of "Removal of the Ossicles." He is sceptical as to the benefits of this operation, as when the ossicles only are affected, expectant treatment may bring about a cure, and if other structures are involved the radical operation must finally be done. Consequently he only recommends ossiculectomy when the ossicles are affected and the hearing is considerably reduced and expectant treatment has been without avail.

In Section II, Chapter 2 and 3, "Opening of the Mastoid Process and of the Antrum" is discussed. Local anesthesia can be employed, if general anæsthesia bids fair to prove dangerous. All loose bone attached to the dura must be removed with blunt hooks, as, if left, it may bring about gangrene of the dural wall. Diseased dura should be widely exposed up to its healthy limits. If it be necessary to remove the whole posterior osseous canal wall, he endorses Winkler's recommendation to form a flap of the posterior soft canal wall and tamponade it into the mastoid wound, so as to bring about a patent canal.

Every collection of granulations must be removed and followed to its termination in healthy bone. He uses the electric head-lamp for illumination. Iodoform gauze, loosely packed, is used.

A trial of Bier's treatment for acute mastoiditis in Heine's clinic on 15 cases, gave 9 cases coming to operation. If the local and general symptoms do not soon improve, then one must not delay operation (and, in the experience of the reviewer, even such

improvement under this plan of treatment may only serve to hide serious mastoid and intracranial involvement in recurrent cases of acute mastoiditis) As a rule, the radical operation is indicated in every case of cholesteatomatous middle ear suppuration Heine believes in the trial of conservative measures first He recommends for irrigation a weak formaline solution The operation is indicated when no improvement appears, when the discharge continues foetid, when in chronic suppuration an acute mastoiditis develops or symptoms of intracranial involvement appear

Heine states that the point of predilection for involvement of the labyrinth is the horizontal semicircular canal, especially on its convexity or its anterior angle When we have vertigo, the best proof that it truly depends upon a disturbance of equilibrium is given when we can demonstrate nystagmus, and then the operation must not be delayed The same warning obtains should facial paralysis appear

In 22 out of 63 cases of uncomplicated diffuse purulent meningitis occurring in the Berlin University ear clinic, the cause of this fatal disease was a suppuration of the labyrinth Operation on the labyrinth always entails a certain danger to the patient We can not with certainty differentiate between a circumscribed and a diffuse labyrinthitis The irritative symptoms are, for the cochlea, subjunctive tinnitus, for the vestibular apparatus, vertigo, disturbances of equilibrium, nystagmus, nausea and vomiting The destructive symptoms are, for the cochlea, deafness, and for the vestibule and semicircular canals, disturbances of equilibrium without vertigo and nystagmus Barany's test, if one syringes a normal or suppurating ear, whose vestibular apparatus is intact, with water below the body temperature, there occurs a rotary nystagmus toward the opposite side and the reverse, toward the syringed ear, occurs if the temperature of the water is above that of the body If no nystagmus appears, then the vestibular apparatus of the diseased ear is destroyed

Heine concludes If a defect of the semicircular canal is found, at first leave it alone, but if labyrinthine symptoms then do not disappear or augment, or first appear after operation with augmentation of the general symptoms, indicating meningitis, then operate on the labyrinth

In Phlebitis and Thrombosis of the Transverse Sinus and the Jugular Vein, Griesinger's symptom, tender circumscribed œdema on the posterior border of the mastoid process, is uncertain, as it may be caused by disease of the bone or frequently by extradural abscesses in the posterior cranial fossa, Gerhardt's symptom, unequal fullness of the external jugular, is also unreliable, and Heine joins with Korner in stating that he has never observed it. The diagnosis is practically impossible if there are no decided symptoms of a general pyæmic infection. Perisinous abscesses, as a rule, give no symptoms on which to base a diagnosis before operation. With high fever, especially in children, every other cause for the fever must be excluded. Exposure of the sinus is not to be considered as a harmless procedure. When in doubt, Heine punctures the sinus as an exploratory measure, and believes this to be much less dangerous than incision, principally because it is not necessary to pack after puncture. He removes the thrombus only so far as it is broken down, and depends upon Nature and frequent changing of dressings to take care of the infection; in exceptional cases, the thrombus is completely removed, especially in the streptococcic infections. Ligation of the jugular is reserved for certain cases only, in which it is clearly indicated.

The question of ligation of the jugular in sinus thrombosis is still debatable, in fact, it may favor an extension of the process to other sinuses, the inferior petrosal, the cavernous, etc., there is the danger that the internal jugular vein of the sound side may be rudimentary, when cerebral œdema or necrosis may follow. (Linsler found that in 3 per cent one jugular foramen was only from three to four mm in size.) Heine ligates when the thrombus is broken down and the sinus wall is discolored, in other cases, if the temperature remains high after operation or mounts after a preliminary fall, with rigors, then the bulb must be cleaned out and the jugular vein be widely opened.

For operative evacuation of Brain Abscesses, he recommends attack through the mastoid, also trial punctures with large canulæ rather than incisions. Heine would not fear to introduce the canula up to 7 cm. If an abscess is discovered, then the dura is incised in the direction of the length of the temporal convolutions. He uses a drainage tube wrapped around with iodoform gauze. One should always remember that brain abscesses are relatively rare, but general brain symptoms, that appear to indi-

cate abscess formations, can appear quite frequently in the course of middle ear suppurations

In Meningitis Serosa, a certain diagnosis is not yet possible; lumbar puncture is to a certain degree helpful. Removal of the focus of disease in the middle ear and exposure of the diseased portion of the brain usually suffices

In Meningitis Purulenta, the prognosis, as with the serous form, is no longer absolutely bad, the middle ear is to be operated upon as early as possible. Circumscribed purulent meningitis is curable. As a rule, to which there are no exceptions, we will not go wrong, if we find by lumbar puncture a purulent liquor containing bacteria, to conclude that we have to do with a leptomeningitis purulenta. Heine holds diffuse purulent meningitis to be incurable. From a clinical point of view, it is not possible to differentiate the circumscribed from the diffuse form

Operation consists in eliminating the infective focus in the bone and exposing the dura, so far as it appears to be unhealthy, in the serious form, we can incise the dura, and finally, we can use lumbar puncture to withdraw a portion of the purulent fluid

Lumbar Puncture In otitis with intracranial complications this is not certainly free from danger, e g, the withdrawal of the liquid may lead to the rupture of an abscess into the ventricle. If from the clinical picture we believe the diagnosis of purulent meningitis justifiable, then we do a lumbar puncture, if the liquid is distinctly purulent and contains bacteria, we do not operate, even if it contains bacteria, or is a purulent liquor without bacteria

HENRY A. ALDERTON

NIERENCHIRURGIE Ein Handbuch für Praktiker von PROF. DR. C. GARRÉ, Geh. Med.-Rath, Direktor der Chirurg. Klinik der Universität Breslau, und DR. O. EHRHARDT, Privatdocent für Chirurgie an der Universität Königsberg i. Pr. Mit 90 Abbildungen im Text. Berlin, 1907. Verlag von S. Karger, Karlstrasse 15

Together with Kuster's contribution on Renal Surgery in "Deutsche Chirurgie, and Israel's Monograph of Surgical Kidney Diseases, the "Nierenchirurgie" of Garré & Erhardt, under consideration constitutes a triad of the German conception of surgical affections of the kidney. Very different from its fore-runners, we note in this latest book a very liberal acknowledg-

ment of the contributions of American authors to this specialty of surgery.

The subject matter is covered in nineteen chapters, excellently illustrated. It is an eminently practical treatise, strikingly void of theories and imbued with healthy, not ultra, conservatism. The opening chapters are devoted to anatomical and physiological considerations followed by remarks on the general principles of operative technique of the kidney and anomalous conditions of the organ. For the treatment of Floating Kidney, the teaching is commendably conservative. Operation is advised when repeated colics are judged to be due to bends and tension of the ureter, if there be a complicating tuberculosis, or hydronephrosis, and when orthopædic measures fail. Hysteria is an absolute contraindication. Guided by these criteria, Garré says the operations are not likely to be listed in the hundreds. The mortality of subcutaneous rupture of the kidney is placed at 47 per cent, therefore the more surprising is the very conservative attitude that operation is to be reserved for severe injuries even though the greater danger of an ascending infection is acknowledged.

In Hydronephrosis, the authors limit nephrectomy to instances of obliterated ureter, where a fistula of the renal pelvis becomes persistent and when suppuration supervenes.

The definitions of Pyelo-Nephritis, Pyelitis, and Pyonephrosis are clearly and sharply drawn. It is shown that these conditions pass into each other and often exist side by side. Lavage with urethral catheter for any other than simple Pyelitis is disparagingly spoken of, for greater infection may supervene and, to be effective, the procedure must be repeated, but this induces nervous exhaustion.

In the chapter detailing the causes of Anuria and Oliguria, the authors prove to be believers in reflex anuria and reno-renal reflex. The latter though can only be established beyond doubt if cystoscopy has been practiced on the remaining kidney.

Essential hematuria is denied and the ability of Edebohls to judge the presence of nephritis by palpation is called to account. Neither is the palpation nor the inspection, nor the microscopic examination of a small piece of kidney sufficient to explain the hematuria. These obscure renal hematurias form the basis of the modern therapy of decapsulation. Nephrotomy is the operation of choice with a section of a thin slice of the parenchyma. Garré,

as the result of personal experience, sees little encouragement in decapsulation for nephritis. The exclusive descending (hæmatogenous) origin of the tuberculous is not conceded. Authors are advocates of early nephrectomy and while admitting the advantages accruing from climatic change and better hygiene, spontaneous cure is denied except that rarely the ureter becomes obliterated. Tuberculin is well spoken of early in the disease and for slight diseased conditions, statistics for renal tuberculosis do not take cognizance of the latest figures of Albarran, Casper and Brown. Ureteral catheterization of the diseased kidney alone is sanctioned, wherefore the use of the "Luy's Separateur" is warmly commended. Again in the diagnosis of nephrolithiasis not much importance is attached to cystoscopy, the X-ray is supreme, and the authors claim a positive finding for all stones if a compression diaphragm is used. Somewhat contradictory is the advice to adhere to Israel's indication to operate for stone only if vital indications prevail and if symptomatic phenomena persist and yet further on the operation is recommended for every stone demonstrable by X-rays. This change of face is based on the very low mortality associated with the operation.

Tumors of the kidney are treated of as those of the parenchyma, the pelvis and the capsule. The comparative frequency in the variety of tumors is not brought out. Common to all tumors is the involvement of the vessels which makes for metastases and dangerous ligation of the vessels with displacement of the thrombus.

In chapter XVII Cystic Tumors, Adenocystomas, Echinococcus Cysts, Aneurysms and Pararenal Cysts are discussed.

The concluding chapter deals with injuries and diseases of the ureter.

MARTIN W. WARE

THE PRACTICE OF PÆDIATRICS, in Original Contributions by American and English Authors. Edited by WALTER LESTER CARR, A. M., M. D., of New York. Illustrated with 199 engravings and 32 full-page plates. Lea Brothers & Co., Philadelphia and New York, 1906.

The volume treating of the practice of Pediatrics, under the editorship of Dr. Carr, of New York, is one of a series of treatises published under the title "The Practitioner's Library." Although there are many books of recent issue treating of the

diseases of infancy and childhood, most of them are the product of the experience of one man, and while such books are in themselves very valuable, still the expression of opinion of a number of eminent pediatricians has a distinct place in the library of the medical practitioner. It is strange, however, to note that all of the American authors follow along the same rut not only in the manner of presenting the subject under discussion, but also in condemning the observation, and oftentimes the experience of other men whose methods of treatment are opposed to their own. The preface states that this volume of Pediatrics is from the pens of well-known authorities in America and England, who have been selected as eminently fitted to write on the subject assigned to them, and to this statement we can take no exception as a glance over the list of contributors justifies it.

In this country we are far behind other nations in provision for the nursing of children, and although the main facts and most of the accepted theories of the best methods of nursing the child are advanced in this volume, still they have not brought forward prominently enough the methods which have been so successfully employed in France and England. One authority tells us that for many years he has used sterilized milk extensively in rearing innumerable infants, without the development of a single case of infantile scurvy, another authority tells us that milk should never be sterilized, and that it is even dangerous to pasteurize milk on account of the dangers of malnutrition. Whom are we to believe? The present work is up to date from the American standpoint, and is a valuable addition to the subject of pediatrics.

PAUL PILCHER.

STUDIEN AUF DEM GEBIETE DES KRIEGSSANITÄTSWESENS IN RUSSISCH-JAPANISCHEM KRIEGE, 1904-1905. By DR. WALTER VON OETTINGEN, Surgeon in Berlin, Chief Surgeon of the Livland Field Hospital of the Red Cross in Eho and Mukden (Manchuria). Dedicated to Professor Ernst von Bergmann upon the celebration of his 70th Birthday. 7 x 10, pp 247, 50 illustrations. August Hirschwald, publisher, Berlin, 1907.

In America so much was written during the Japanese-Russian War concerning the military operations upon land and sea of the Japanese, and so much attention was paid to the extra-

ordinary achievements in military hygiene, and in the actual care of the sick and wounded men in the camp and on the battlefield by the Japanese, that it is something of a relief, professionally, to find that in certain ways, at least, the Russian forces endeavored, so far as they could, to accomplish similar results within their own military sphere of action. It is therefore with especial interest that one reads this book by Dr. Walter von Oettingen, a surgeon of Berlin who accompanied the field hospital of the Red Cross in the campaigns at Eho and at Mukden, in Manchuria. The unusual experiences which the author underwent during this campaign, he has grouped together in the present volume, and dedicated them to his former chief, Professor Ernst von Bergmann as a part of the "Festschrift" published upon the occasion of the seventieth birthday of that distinguished surgeon.

When the climatic difficulties which attended this series of active campaigns are considered, the results obtained must be considered remarkable. The effort was made, so far as possible to avail himself of the practical teaching and experience acquired by von Bergmann in the Turkish War, and to secure, so far as circumstances would permit, the greatest possible relief for the sick and wounded in the field.

The material in the volume may be divided into two general sub-divisions, the first dealing with the preparations and activities in the Red Cross hospitals from November, 1904, until the 26th of February, 1905, and the second a description of the medical experience which took place during the famous twelve days' battle at Mukden, lasting from the 25th of February until the 9th of March, 1905.

Under the first subdivision, military surgeons will find much of value in the detailed descriptions of the means of transportation and of the construction of field hospitals in a country where the ground was frozen to a depth of many feet during a large portion of the year, and where the mere necessity for obtaining sufficient warmth to prevent the wounded from being frozen to death even after they had entered the hospital wards, was one of the most difficult problems that the military surgeon had to solve. The surgical equipment and the details of administration are also of much interest, and are made of value by the numerous illustrations in the text.

A special experience was gained in the use of the portable Dockers barracks. When the war was declared, it was decided to take five of these portable structures with the Red Cross, into the field, although it was maintained by many that the use of these structures in a climate like that of Manchuria, was ill advised.

As a matter of fact, however, the results obtained were very satisfactory, and this was especially true when the site of the hospital was not too great a distance from the railway. With a practiced Hospital Corps, it was found possible to erect this field hospital in from seven to eight hours, and under favorable conditions, even greater speed in preparation was achieved. The result was that in many instances, two well equipped operating rooms were made available in a short time, and in connection with these, a dispensary for the administration of medicines and the distribution of field medical supplies.

Another detail of construction of interest to military surgeons, was the use of earth huts of kind commonly used in Siberia by the peasants. These were amplified for military purposes into much larger structures, some of them 24 metres wide and 60 metres long. The greatest height at the apex of the roof in these large hospital wards so constructed, was 18 feet, and at the side the eaves reached practically to the level of the ground. Trenches four feet deep are dug longitudinally through the floor of this structure and upon the layers of earth left between the trenches in strips 15 feet wide, the blankets of the wounded were laid and improvised beds were constructed. In this manner the surgeons were able to reach the patients in the ward in the easiest way and to have them at a suitable height for proper care. Ventilation was secured by openings at regular intervals in the roof which was covered thickly with earth to maintain warmth, and at each end through double doorways and windows giving access to the wards and permitting them to be light.

Many interesting and accurate details are given of the different structures and dressings that were improvised in similar ways, growing out of the necessities of the country and the climate.

In the section devoted to the "Twelve Days' Fight," the transportation of the wounded the first day upon the battlefield

itself, the class of injuries, particularly those caused by modern small caliber high power projectiles from the infantry rifle, and the other class caused by shrapnel so freely used by the Japanese in their field artillery, receive especial attention

As a whole, the book is a most interesting and profitable one. It supplies to the professional reader many new ideas as to the manner of guarding against infection and of securing good results under the most unfavorable conditions, and to the lay reader it presents in a vivid manner the difficulties and dangers that attend the prosecution of an actual campaign where both man and nature have combined to render mere existence almost an impossibility. To both it brings vividly to mind the celebrated axiom attributed to Gen. Sherman, that "War is Hell!"

HENRY P. DE FORREST

THE DIAGNOSIS AND TREATMENT OF DISEASES OF WOMEN By HARRY S. CROSSEN, M.D., Clinical Professor of Gynecology, Washington University, St. Louis, Mo., etc. 799 pages and 700 illustrations. C. W. Mosby Medical Book and Publishing Co., St. Louis, Mo., 1907.

The author sets forth the aims of the book in its preface. It "is devoted exclusively to the diagnosis and treatment of diseases of women as those diseases are met with in the office and at the bedside by the general practitioner. No space is given to other considerations (etiology, pathology, major operative technique), except as necessary to bring the work to its highest usefulness as a practical guide in the lines indicated. While no space is taken up with detailed technical descriptions of major operations, much care is taken to set forth clearly the differential diagnosis of the various conditions requiring such operative treatment, the kind of operation called for by the particular conditions present, what the operation is intended to accomplish, the preparation of the patient for operation and the after care necessary to complete the restoration to health."

Over 220 of the 700 illustrations are original and many of these are reproductions of photographs which represent the various steps in the diagnosis and treatment of pelvic disorders. The remaining illustrations have been chosen from various sources and due acknowledgment and credit is given these sources both in the preface and text.

As has been stated, the work is devoted exclusively to the

diagnosis and treatment of diseases of women from the standpoint of the general practitioner. The writer has born this in mind throughout the entire book and has very carefully described and illustrated (especially by photographs) each procedure which he has deemed necessary for the practitioner to understand. The systematic arrangement of the subject matter and the very careful attention to detail (though at times apparently too explicit), both in the text and in the illustrations, should prove of value to the general practitioner who has not had sufficient training in gynecological diagnosis, especially if he lives far from a medical centre and has to rely on his own resources

JOHN A. SAMPSON

THE OPERATIONS OF SURGERY. By W H A JACOBSON, M Ch Oxon, F R C.S., Consulting Surgeon Guy's Hospital, and R P ROWLANDS, M.S, F.R C S, Assistant Surgeon Guy's Hospital, Joint Teacher of Operative Surgery in the Medical School. Fifth edition. 777 illustrations. Vol I, 8vo., pp 926. Vol II, 8vo., pp 1139. London J & A Churchill Philadelphia P Blakiston's Sons & Co 1907

The advances in operative surgery which have taken place since 1902, when the fourth edition of Jacobson's appeared, have been so extensive that a most thorough and comprehensive revision had become a necessity if the author wished to have his work continue as a reference book for students and practitioners. This is accomplished in the present edition by the aid of Mr R. P Rowlands, who has taken Mr Steward's place and has written the sections dealing with the general surgery of the abdomen, and Mr D B Smith, who has made himself responsible for the re-written and thoroughly revised chapters on "Operations on the Ovary and Uterus". We regret to note the author's determination to make this the last edition in which he will take an active part.

Volume I deals with the operations on the upper extremity, head, neck and thorax. The author has wisely omitted the insertion of meaningless illustrations of procedures and instruments, preferring to quote cases which illustrate the point needing explanation, the book is remarkable for the number and completeness of such interpolations.

Owing to the frequency with which infusion is performed, attention should be drawn to the poor technique the author has

given in his description of this minor operation, I am sure a young man, following the method here described, would have trouble in introducing the cannula and also run a great risk of sweeping into the circulation a blood-clot which may have formed in it. How much simpler and cleaner it is to insert the cannula while the solution is flowing from its open end, obviating absolutely any chance of clot or air embolus. The author makes no mention whatever of the introduction of opsonins, which would naturally come after his article on antiseptic injections. This subject has beyond doubt already proved that it is worthy of a surgeon's most serious consideration.

The operations on the brain, their indications and technique are well considered. The author, however, does not mention the latest and successful operations on tumors of the base of the brain, and also those for the removal of tumors or cysts of the pituitary body, these have been successfully performed, have absolute indications, require certain technique, and will hereafter have to be considered. In the chapter pertaining to operations on the œsophagus, we remark an exceptional omission, *i e*, the œsophagoscope, a similar criticism is to be made concerning the bronchoscope. How much easier for the operator and safer for the patient it is to have foreign bodies removed per viam naturalem, than by thoracotomy or tracheotomy.

Volume II, containing, in the greater part, the work of Rowlands and Smith, treats exhaustively the surgery of the abdomen, lower extremity and vertebral column. The author devotes four pages to the description and problematical use of the Luy's segregator or separator, an instrument whose inefficiency has so often been demonstrated and the results for operative interference gained by its use are so questionable, that in place of lauding its virtues, the same space might be better applied to describing its restrictions. On the other hand, the cystoscope has been very inadequately considered, ureteral catheterization is merely mentioned, on page 254, and then only to be condemned by quotations from Morris, the *modus operandi* of its accomplishment is not even indicated. Lavage or antiseptic injection of the pelvis of the kidney in pyelitis per se, or collection of urine by use of the cystoscope and ureteral catheters is entirely omitted.

The author, in the sections devoted to the operations on the stomach, has shown excellent judgment in his selection of cuts and descriptive methods, no small task in these days when our

surgical literature is so surfeited with new and startling innovations. The condemnation of the use of the Murphy button is a noticeable feature; we feel, however, that the field of its usefulness is probably greater than the author ascribes to it. Post-operative ileus and acute gastric dilatation should have received more attention than the mere mention of the condition. Whitehead's operation for hemorrhoids is described to be, in the majority of cases, too radical and too often followed by unfortunate sequelæ, a judgment in which, I think, most surgeons must concur. On the subject of spinal anesthesia, the author mentions the fact of its limited use and frequent inefficiency, to this the writer takes exception, and notes the omission of the cardinal rules which should be observed to effect its being obtained, that is, the site of injection and the rapidity and degree of inversion of the patient.

The most notable features of the book, aside from its completeness, are the fully considered and well presented judgments and operative innovations that are ascribed to American surgeons, a condition no book which has previously come under our notice has contained and which ought to insure for it a most favorable reception in this country. The authors are to be congratulated on the fullness and conciseness of their descriptions and on their many and judicial discussions.

JAMES TAFT PILCHER.

A TEXT-BOOK OF PRACTICAL GYNÆCOLOGY FOR PRACTITIONERS AND STUDENTS. By D. TOD GILLIAM, M.D., Emeritus Professor of Gynæcology in Sterling-Ohio Medical College, etc. Second Revised Edition. F. A. Davis Company, Publishers, Philadelphia, Pa., 1907.

In the present volume the writer has presented what he believes the student and busy practitioner should know about the diseases of women. The scope and size of the work, of necessity, limits the fuller treatment of the various subjects in gynecology. As in other works of its class its chief value lies in the presentation of methods of diagnosis and treatment which, from practical experience, the author has proven to have been of value to him.

In the style of the book, *i.e.*, a "plain connected narrative" the writer has presented us with one of the most readable and concise works on any medical subject.

JOHN A. SAMPSON.

A MANUAL OF ORTHOPEDIC SURGERY, by AUGUSTUS THORNDIKE, M D, Assistant in Orthopedics at the Harvard Medical School, Visiting Surgeon to the House of the Good Samaritan, Assistant Orthopedic Surgeon to the Children's Hospital, Boston P Blakiston's Sons & Co, Phila 1907

This short concise handbook meets a real want for a book on Orthopedic Surgery which is comprehensive and yet omits needless detail. It is probably the best book on the subject to give to the student in the medical schools for collateral reading in connection with the lectures on Orthopedic Surgery. For the practitioner who wishes a quick and accurate reference, it has merit, and the orthopedic surgeon will find the divisions very clearly presented and the whole subject brought up to date.

It would appear that the first chapter, on the malformations of the limbs, laid perhaps too much stress upon the unusual deformities of intra-uterine formation—deformities which are oftener seen in medical museums than in actual practice. The concise treatment of the subject of the orthopedic care of infantile paralysis and the practical chapter on the use of plaster-of-paris should be especially noted. The pictures are well chosen and the form of the volume is convenient for carrying.

WALTER TRUSLOW

METABOLISM AND PRACTICAL MEDICINE By CARL VON NOORDEN, Professor of the First University Clinic, Vienna Anglo-American Issue under the Editorship of I Walker Hall, Professor of Pathology, University College, Bristol Vol I The Physiology of Metabolism, by Adolf Magnus-Levy, Berlin Vol II The Pathology of Metabolism, by Carl von Noorden, Fr Kraus, Ad Schmidt, W Weintraud, M Matthes and H Strauss Chicago 1907, W T Keener and Co

Though based upon von Noorden's smaller work on metabolism this Anglo-American Issue represents the combined labor of a score of authors, many of whom are well-known workers in the fields with which their respective articles deal.

These two volumes contain an encyclopedic account of the physiology and pathology of metabolism, a vast amount of data being presented in readily utilizable form, unsettled questions

critically discussed and warrantable conclusions clearly stated. Though brevity of statement is the rule there is no dearth of detail, but in places the impression forces itself upon one that the author of a given chapter had not thoroughly digested the material at hand before attempting to write an account of it

As a whole, the work is well done, and its authors deserve a high degree of commendation, and those of us who admit the truth of the conception that many, if not all diseases are, essentially disturbances of metabolism, will find this treatise to be a veritable storehouse of information.

J. C. CARDWELL.

BIER'S HYPERÆMIC TREATMENT. By WILLY MEYER, M D, Professor of Surgery, New York Post-Graduate School and Hospital, and Professor Dr. VICTOR SCHMIEDEN, Assistant to Professor Bier, University of Berlin, Germany. Octavo of 209 pages Illustrated W B Saunders Company, Philadelphia and London. 1908.

We have for some years past been anticipating the appearance of some book descriptive of the method which Dr. Bier so extensively employs. This has at last been given us by the authors in the present volume. The various and interesting theories which have been promulgated as to the real working of this procedure are omitted, as are also any mention of illustrative cases. In Dr. Bier's personal writings these both find expression, and tend rather to lend interest as well as scientific introspection than to detract from it.

The book is well and instructively illustrated with the more or less familiar suction apparatuses, hot air boxes and elastic appliances. In the ingeniousness of the devices for cupping the various parts of the body, and in the larger vacuum chambers, we recognize the exceptional and fertile originality and mechanical aptitude of Dr. Klapp.

The working theory of these various appliances is easily summed up. Accepting the fact that hyperemia is the physiological process by which inflammation or infection is to be combated, we deduce that in so far as it may be possible to increase this process just so much greater will be the benefit derived by the invaded tissue. Thus while previously inflammations were

considered detrimental so that the physician's first duty was to fight them, now we go to the other extreme and attempt to artificially increase the redness, swelling and heat, three of the four cardinal symptoms of acute inflammation

This book deals with the practical application of this theory and is divided into a General and a Special Part. The former taking into consideration the advantages of the hyperemic treatment over other methods, the methods of inducing hyperemia, and the general rules for the application of hyperemia, that is, elastic bandage, suction apparatus and hot air. In the Special Part the treatment of diseases and conditions of the entire field of medicine and surgery are taken up, including surgery, medicine, gynecology and obstetrics, genito-urinary surgery, otology, ophthalmology, rhinology, pharyngology and laryngology, neurology including psychiatry, and finally dermatology.

The text is clearly printed, terse and lucid, in the wide margins at the side is appended on each page, in heavy type, the subject which is described on that page, thus facilitating ease of reference. The English nomenclature for this process is certainly puzzling, nothing we have seems to express clearly and correctly just what we want, it is very probable and not inappropriate that the German terminology of "Stauung's Hyperæmie" should be taken over bodily.

The most fully treated affections and those from which we are able to draw the best conclusions because of the greatest experience with them, are probably the tubercular affections, principally of the joints, mastitis and the acute infections, especially gonorrhœal arthritis. There are many things to which objections may be taken, probably the mention of the most obvious will suffice. The advice of applying a neck band for invasion of the mastoid is to be condemned, the dangers accruing from such a procedure are so much greater than any problematical benefit, the easy inception of a lateral sinus thrombosis, brain abscess, septicemia, etc., which can not be appreciated because of a complete masking of the symptoms. In fact, this particular application for any reason, except in the young, is fraught with the risk of the most serious consequences, for who is there that can say what are the conditions of the cerebral arteries, even though superficial ones may appear perfectly normal? The facts should receive consideration, even by an enthusiast, that the clinics of

Europe, even in Bonn itself, have completely discarded and absolutely condemned this method.

Generally, judgment of the highest order and wide observation are required. Continual observation of this procedure, at least where major and dangerous conditions are present, should be insisted upon, and this can not be obtained nor given by the ordinary practitioner; it can only find its advocates among those of large hospital experience. Its expensiveness makes it impracticable for other than institutional application, except, of course, in minor conditions.

Thus one comes to appreciate that the drawbacks in some degree counterbalance the proffered advantages, and it will be some years yet before we can strike the mean between the extremes which are at present existing between Berlin and the rest of the medical world

JAMES TAFT PILCHER

OPHTHALMIC SURGERY By DR JOSEF MELLER, of Vienna,
P. Blakiston's Sons and Company

While nothing less than continued actual experience can give to one the skill necessary to successfully practice surgery, and particularly ophthalmic surgery, there is published once in a great while a book that seems almost to be a connecting link between the theory and practice, and this may be stated of the one under review, for we rarely see a work in which the illustrations are as true to real conditions, or the descriptions as lucid as is the case here

The operation for excision of the lachrymal sac, which is being more frequently performed of late than formerly, is graphically portrayed; and as much may be said concerning the operations for removal of the lachrymal gland and for passing the nasal probe

The various operations upon the eyelids for entropion, ectropion and canthoplasty, are made very clear, as are also those upon the eye muscles, including "advancement" The plastic operations done upon the lids are well described.

Much space and detail have been given to the operations for the extraction of senile cataract and iridectomy in glaucoma

Concerning the chapter dealing with the cataract operation, while the reviewer is in accord with most of the valuable sugges-

tions, issue is taken with the advice to the surgeon to stand or sit at the patient's side while operating, as it is believed that the knife is under much better control when being drawn toward the operator, than when being pushed from him. The reviewer regards the cystotome in the hands of the majority of operators as a much safer instrument with which to rupture the lens capsule than the capsule forceps, which in the hands of all but the most expert may easily cause dislocation of the lens by pressure. At the present time there seems to be a tendency to the practice of performing a preliminary iridectomy in cataract extraction.

The various steps in the operation of iridectomy for glaucoma are very satisfactorily explained. The reasons for using either one of the two kinds of knives, Graefe cataract knife, or lance, are set forth. The reviewer believes that there is less danger of injury to the lens and to the base of the iris with the use of the Graefe knife, and agrees with the author in believing that the wound made with this knife, because of its slight tardiness in healing, is one more favorable to the end we wish to attain. The author commits himself to neither choice. In acute inflammatory glaucoma a general anæsthetic is to be advised, because of the probability of the pain making the patient intractable.

In general it may be stated, that this volume should receive a most sincere welcome, as it must prove of great value to all, and more especially to those who have not the opportunity of attaining wide practical experience, for it is they who are liable to neglect details that are clearly set forth in this book, and the omission of which often does so much to defeat the purpose desired. There is no hesitancy in recommending this work to the attention of every ophthalmologist, even for those who are more mature in this practice it will prove a classic in ophthalmic literature, and a distinct addition to any library.

JAMES COLE HANCOCK

ADENOMYOMA OF THE UTERUS. By THOMAS S. CULLEN, M.B., Associate Professor of Gynæcology, in Johns Hopkins University. Large octavo of 270 pages and with 68 illustrations by August Horn, Hermann Becker and Max Broedel. Philadelphia and London W. B. Saunders Company, 1908.

This work is based on the careful study of over ninety cases of this condition. The material was obtained chiefly from the

Gynæcological Department of the Johns Hopkins Hospital and from Dr. Kelly's private sanitarium. The writer found this condition in 57 per cent. of 1283 specimens of myoma examined from April 1, 1893, until July 1, 1906.

The early literature of the subject is first discussed and this is followed by a report of several cases, which constitutes the bulk of the book.

In the report of the cases, the clinical history is first given, then a description of the operation, gross appearance of the specimen removed and the result of the microscopical examination of pieces of tissue removed from the specimen. After the report of the cases the writer discusses, in separate chapters, the clinical picture of this condition, differential diagnosis, treatment, prognosis, origin and cause.

He divides adenomyomata into the following groups:

1. Adenomyomata in which the uterus preserves a relatively normal contour

2. Subperitoneal or intraligamentary adenomyomata

3. Submucous adenomyomata

He believes that all adenomyomata of the uterus in which the glandular elements are similar to those of the uterine mucosa, and are surrounded by stroma characteristic of that surrounding the normal uterine glands, owe their glandular origin to the uterine mucosa, or to Muller's duct, no matter whether they be interstitial, subperitoneal or intraligamentary, whether solid or cystic.

Lengthened menstrual periods are the first symptoms. The flow gradually assumes the proportions of hemorrhages and eventually the period may become continuous. The menstrual period is usually associated with dysmenorrhœa. The writer believes that diffuse adenomyoma is the only pathological condition of the uterus which, as a rule, gives the following clinical picture:

1. The bleeding is usually confined to the period

2. There is usually much pain, referred to the uterus, at the period

3. There is usually no intermenstrual discharge of any kind

4. The uterine mucosa is perfectly normal and may be rather thick

The only way to control the bleeding is to remove the uterus and the prognosis for a cure is excellent.

The book-making is of the best, and many of the sixty-eight illustrations are among the finest in medical literature. To the gynæcologist, pathologist, and all others interested in adenomyomata, this monograph with report of cases should prove interesting

JOHN A. SAMPSON

ANÆSTHETICS THEIR USES AND ADMINISTRATION By DUDLEY WILMOT BUXTON, M D, B S, Member of the Royal College of Physicians Fourth Edition London, Philadelphia. P Blakiston's Son & Co. 1907

The book deals with all the methods of producing *anæsthesia* including in this new edition the use of ethyl chloride as a general *anæsthetic* and the production of *anæsthesia* by spinal injection

The author first advises the beginner how to approach the study of *anæsthesia*. The historical data is given in an interesting chapter. Then follows a chapter on the preparation of the patient and the choice of *anæsthetic*. The relation of *anæsthesia* to disease, the special requirements in operations about the head, neck, face, trachea, and respiratory tract, the methods of administration in Abdominal Surgery and in Labor are all thoroughly discussed

The chapters on general *anæsthesia* are good, but the chapter on Local Analgesia is not sufficiently up to date. Local analgesia is being used more frequently than in former years and this subject deserves fuller consideration

Many of the American and German inventions have not been mentioned, but if these had been included they might confuse rather than enlighten the student

The book has been carefully written and is accurate in its teachings

TO CONTRIBUTORS AND SUBSCRIBERS

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 386 Grand Ave., Brooklyn, N Y.

Remittance for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS OF SURGERY,
227-231 South Sixth Street,
Philadelphia

INDEX TO VOLUME XLVIII.

A

- ABBE, ROBERT, Aneurysmorrhaphy, Personal Experience with the Modern Method of Treating Aneurysm, 10
- Abdomen, Gunshot Wound of, involving Stomach and Jejunum, Complicated with Pregnancy, 857
- Abdominal Wall, Desmoid Tumors of the, 175
- ABRAHAMSON, I, Traumatic Aphasia from Contre Coup, 614
- Acoustic Nerve, Craniotomy for Tumor of, 309
- Acromegaly, Cure of, by Removal of Hypophysial Tumor, 781
- Ainhum, 110
- ALDEN, ELIOT, Some Deformities of the Hand, 915
- ALEXANDER, SAMUEL, Contribution to the Surgery of the Prostate, 266, Encysted Hydrocele of the Cord (Inguinal Portion) Resembling Omental Hernia, 448, Epithelioma of Penis, 449, 450, 451; Fracture of the Pelvis, Rupture and Laceration of the Urethra, 447, Ureteral Calculus (Two Cases), Improved Method of Approach, 445
- ALLEN, FRANCIS O, Hemophilia Treated by Transfusion, 625
- ALLIS, OSCAR H, Fibro-lipoma of Synovial Folds of Knee-joint, 787; Gas-ether Anæsthesia, 479
- Amputation, Gritti's, Nerve Blocking and Regional Anæsthesia in, 903
- Anæsthesia, Gas-ether, Twenty-five Hundred Cases without Complication, 435, General, by Ethyl Chloride, at the Pennsylvania Hospital, 641, 795, Local, in the Extremities, Bier's Method, 780, Regional, in the Gritti Amputation, 903
- Anæsthetics, by Dudley Wilmot Buxton, Review of, 960
- Anastomosis, Arteriovenous, for Gangrene, 897, End-to-End, of the Brachial Artery, 152, Intestinal, Method to Facilitate the Avoidance of Infection during, 554
- Aneurysm, Personal Experience with the Modern Method of Treating Aneurysm, 10, Popliteal, Treatment by the Reconstructive Method, 1, Popliteal, Presenting Unusual Difficulties in the Matas Operation, 15
- Aneurysmorrhaphy, 1, 10, 15
- Angina, Ludwig's, Report of Five Cases, 649, 788
- Ankylosis of Elbow, Arthroplasty for, 711
- Aphasia, Traumatic, from Contre Coup, 612
- Appendectomy, Hemorrhage from the Bowel Following, 626, Treatment of the Appendix Stump after, 74
- Appendicitis, 137, Causing Diffuse Peritonitis, Results of Postural Treatment, 828, Hæmaturia as a Complicating Factor in, 388
- Appendicitis and Tetany, 859
- Appendix Vermiformis, Hernia of the, Complicated with Appendicitis, 199, Misplaced, 137; Primary Carcinoma of the, 128, 192, 560, 563; Primary Sarcoma of the, 607

- Appendix-stump, Treatment of the, after Appendectomy, 74
- Argyrol, Use of, in the Preparation of Catgut, 769
- ARMSTRONG, GEORGE E., Diagnosis and Prognosis of Tuberculous and Septic Conditions of the Kidney, 88
- Arteriovenous Anastomosis for Gangrene, 897
- Arthritis of the Knee, Suppurative, 467
- Arthroplasty for Ankylosis of Elbow, 711
- ASHHURST, A P C., Infantile Paralysis Treated by Tendon Transplantation and Nerve Anastomosis, 470, 476, Hemorrhage from the Bowel Following Appendectomy, 630, Traumatic Cerebral Hemorrhage, 635, The Conservative Treatment of Fractures of the Femur, 748, 790

B

- BABLER, EDMUND A., Ainhum, 110
- BARTLETT, WILLARD, Huge Biliary Calculus Removed From the Common Duct, 676
- BASHAM, DAVID WALKER, Hernia of the Appendix, Complicated with Appendicitis, 199
- BEAL, HOWARD W., Fibrinous Calculi in the Kidney, 378
- BERG, ALBERT A., The Radical Treatment of Carcinoma of the Bladder, 355
- Bier's Hyperæmic Treatment, Meyer and Schmieden on, Review of, 955
- Bile-duct, Cause of Sudden Fall in Blood-pressure While Exploring the Common, 550
- Biliary Calculus, Huge, Removal from Common Duct, 676
- BINNIE, JOHN FAIRBAIRN, Aneurysmorrhaphy Treatment of Popliteal Aneurysm by the Reconstructive Method, 1.
- Bladder, Urinary, Papillomata of the, 305, Radical Treatment of Carcinoma of, 355, Transperitoneal Removal of Tumors of the, 105, 862
- Bladder-tumor, Hydronephrosis Due to Ureter Obstruction by, 314
- BLAKE, JOSEPH A., Aneurysmorrhaphy, 15, Excision of Carcinoma of the Rectum by the Combined Method, 80, 150, Fractured Skull, with Extradural Hemorrhage, 125, Perforated Ulcer of the Duodenum, 129, Perforated Gastric Ulcer, Diffuse Peritonitis, Peritoneal Lavage, Closure without Drainage, 130, 131; Perforating Gastric Ulcer, 132, Typhoid Perforation of the Ileum, 135, Appendicitis Misplaced Appendix, 138, Stab Wound of Heart, Suture, Double Lobar Pneumonia, Emphysema, Thoracotomy, Drainage, 138, Benign Stricture of the Oesophagus, Gastrostomy, Dilatation by the String Method, 147, Interstitial Nephritis with Multiple Abscess Formation, 149, Volkmann's Ischæmic Paralysis, 453, Perforating Duodenal Ulcer, 464, Treatment of Undescended or Maldescended Testis, 469, Peritonitis with Unknown Site of Infection, 934
- Blastomycosis of the Spine, 889
- Blood-pressure, Cause of Sudden Fall in, While Exploring the Common Bile-duct, 550
- Blood-vessels, Serous Coat of, Compared with the Peritoneum, 18
- Bone Plastics and Bone Transplantation, 779

- Bone Surgery, A New Motor for, 303.
- Brachial Artery, End-to-End Anastomosis of the, 152
- Brain-tumor (Hypophysis) Removal for Cure of Acromegaly, 781.
- BRANHAM, JOSEPH H, Tetany Following Thyroidectomy Cured by the Subcutaneous Injection of Parathyroid Emulsion, 161
- Breast, Cancer of, Recurrence at Late Period, 527, Carcinoma of the Male, 464
- Breast-tumors in Childhood, 662
- BREWER, GEORGE E, Cerebral Injury Due to a Depressed Fracture of the Skull in an Infant, 125, Appendicitis Misplaced Appendix, 138, Interstitial Nephritis with Multiple Abscess Formation, 149, Suppurating Hydatid Liver Cyst Complicating Cholelithiasis, 615, Oesophageal Diverticulum, 615, Two Perforations of a Gastric Ulcer, within Six Months, 620, Blastomycosis of the Spine, 889
- BRINSMADE, WM B, Chyle Cysts of the Mesentery, 565
- BROWN, F TILDEN, Ureterostomy and Nephrostomy for Hydronephrosis, 314
- BRYANT, W SOHIER, A New Motor for Bone Surgery, 303
- Bunion, The Surgical Treatment of, 300
- Bursæ About the Knee-joint, 724
- Buxton on Anæsthetics, Review of, 960
- C
- Calculi, Fibrinous, in the Kidney, 378
- Calculus, Ureteral, 445
- Cancer Treated by Massive Electric Sparks (Fulguration), 776
- Caries Sicca, 151
- CARR, WALTER L, The Practice of Pædiatrics, Review of, 946
- Catgut, Silverized, 769
- Cerebral Hemorrhage, Traumatic, 633
- Cerebral Injury Due to Depressed Fracture of the Skull, 125
- Cervical Lymph-nodes, Technic of Early Operation for the Removal of Tubercular, 169
- Cheek, Carcinoma of Inner Side of, 313; Involving the Jaw, Method of Operation in Extensive Cancerous Growths of the, 515
- Childhood, Breast-tumors in, 662
- Children, Peritonitis in, From Unknown Sites of Infection, 821, 932
- Cholangitis Due to Colon Bacillus Infection, 922
- Cholelithiasis Complicated by Hydatid Liver Cyst, 614
- Chyle Cysts of the Mesentery, 565
- COBB, FARRAR, Recurrent Dislocation of the Ulnar Nerve Report of a Second Case Cured by Operation, 409, Acute Hæmatogenous Infection of one Kidney in Persons Apparently Well, 680.
- COLEY, WM B, The Treatment of the Undescended or Maldescended Testis Associated with Inguinal Hernia, 321, 468, 469, Carcinoma of the Male Breast, 465, Sarcoma of the Back, Treatment with the Mixed Toxins, 465
- Colon, Resection of, 314
- Costal Arch, Osteoplastic Resection of, 530
- Coxa Vara, Operative Treatment of, 446
- Craniotomy for Tumor of Acoustic Nerve, 309
- CROSSEN, HARRY S, The Diagnosis and Treatment of Diseases of Women, Review of, 950

Cullen on Adenomyoma of the Uterus, Review of, 958
Cystotomy, Intraperitoneal, Harrington's Operation of, 862

D

DAVIS, GWILYM G., Infantile Paralysis Treated by Tendon Transplantation and Nerve Anastomosis, 476, Gas-ether Anæsthesia, 477, Traumatic Cerebral Hemorrhage, 633, Removal of the Lingual and Mandibular Nerves by the Twisting Method of Thiersch, 636, 639, Ludwig's Angina, 789, Treatment of Fractures of the Femur, 791, Gersuny's Operation for the Cure of Enuresis, 792, Method of Anastomosing the Vas Deferens, 793
DAVIS, LINCOLN, Harrington's Operation of Intraperitoneal Cystotomy, 862
DE GARMO, Abdominal Hernia, its Diagnosis and Treatment, Review of, 316
Desmoid Tumors of the Adominal Wall, 175
Diaphanoscopy, Gastric, 785
Dilatation of Stomach, Acute, Complicating Typhoid Fever, 678
Diverticulum, Œsophageal, 615
DORRANCE, GEORGE M., Gunshot Injury of the Left Hypoglossal Nerve, 160
DOWD, CHARLES N., Benign Stricture of the Œsophagus, Gastrotomy, Dilatation by the String Method, 147, Technic of Early Operation for the Removal of Tubercular Cervical Lymph-nodes, 169, Treatment of Undescended or Maldescended Testis, 468, Chyle Cysts of the Mesentery, 623, Peritonitis in Children From Unknown Sites of Infection, 821, 932

DOWNES, WILLIAM A., Operation for Old Injury of the Forearm, Involving the Flexor Tendons, Median and Ulnar Nerves, 451; Perforating Duodenal Ulcer, 461
Duodenal Uleer, Perforating, 129, 461

E

Ear, Heine on Operations for Suppuration in the Middle Ear and its Intracranial Complications, Review of, 911
EISENDRATH, DANIEL N., Contribution to Renal and Ureteral Surgery, 703
EISING, EUGENE H., Prevesical Abscess, 224
Elbow-ankylosis, Arthroplasty for, 711
Elbow, Backward Dislocation of, 621, Resection of Tuberculous, 454
ELDER, J. M., Primary Sarcoma of the Peritoneum, 848
ELIOT, JR., ELLSWORTH, Perforating Duodenal Ulcer, 463, Backward Dislocation of the Elbow Ulnar Paralysis, 622; Question of Gastro-enterostomy in Ulcers of Stomach, 927, Peritonitis with Unknown Site of Infection, 933
ELSBERG, CHARLES A., Craniotomy for Tumor of Acoustic Nerve, 312, Traumatic Aphasia from Contre Coup, 613
Embolism of the Pulmonary Artery, Operative Interference in, 772
Emphysema, 138
Endotheliomatous Cyst of the Great Omentum, 206
Enterostomy, 314
Enuresis, Cure of, Gersuny's Operation for, 792
Epididymitis, Acute Gonorrhæal, Operative Treatment of, 876

Epidural Hemorrhage, Traumatic, 122.

ERDMANN, JOHN F., Papillomata of the Bladder, 305, Volkmann's Ischæmic Paralysis, 452, Carcinoma of the Male Breast, 465, Treatment of Undescended or Maldescended Testis, 469, Sarcoma of the Ovary in a Child, 619, Suprapubic Prostatectomy, 624, Reamputation of Lower End of Leg for Exostosis in a Previous Bier Amputation, 624, Peritonitis in Children with Unknown Site of Infection, 934

Ethyl Chloride as a General Anæsthetic in the Pennsylvania Hospital, 641, 795

External Iliac Arteries, Simultaneous Ligation of both, 872

Extradural Hemorrhage, Fractured Skull with, 125

F

Femoral Hernia, Strangulated, 442
Femoral Shaft, Operative Treatment of Recent Fractures of, 420

Femur, Fractures of the, Conservative Treatment of, 748, 790

Femur, Fracture of the Neck of the, 447; In Adults, Operative Treatment of, 729

Finger-enucleation of the Tonsil, 883

FLINT, CARLETON P, Sinus of First Branchial Cleft, 165, The Operative Treatment of Fracture of the Neck of the Femur in Adults, 729

FOOTE, Text-book of Minor Surgery, Review of, 319

Forearm, Operation for Old Injury of the, Involving Flexor Tendons, Median and Ulnar Nerves, 451

FOWLER, ROYALE HAMILTON, Diffuse Septic Peritonitis Due to

Appendicitis, After-treatment with Postural Drainage, 828

FRAZIER, CHARLES H, Gas-ether Anæsthesia, 479

Fulguration as a Treatment for Cancer, 776

G

GALLAUDET, B B, Traumatic Epidural and Intracerebral Hemorrhage, 122

Gall-bladder, Gangrene of the, 72

GAGE, HOMER, Fibrinous Calculi in the Kidney, 378

Gangrene of the Gall-bladder, 72

GARDNER, FAXTON E, The Etiology of Hydronephrosis, 575

Garré and Ehrhardt's Hand-book on Kidney-surgery, Review of, 944

GARROW, A E, Primary Carcinoma of the Appendix, 560

Gas-ether Anæsthesia, 435

Gastrectomy, Partial, for Unusually Situated Cancer, 444

Gastric Ulcer, Perforated, 130, 131, 135, 460, 620, 926

Gastroduodenoscopy and Diaphanoscopy, 785

Gastro-enterostomy, 136

Gastrostomy, 146

Gauze Pack, The Inconsistencies of the, 219

German Surgical Society, Congress of 1908, Excerpts From the Transactions of the, 772

Gersuny's Operation for the Cure of Enuresis, 792

GIBBON, JOHN H, Rupture of the Spleen, 152, End-to-End Anastomosis of the Brachial Artery, 154; Gas-ether Anæsthesia, 480, Use of Chloride of Ethyl as a General Anæsthetic, 795

GIBSON, CHARLES L, Ureteral Calculus, Improved Method of Approach, 445, Epithelioma of Penis, 450; Perforating Gastric

- Ulcer, 460, Carcinoma of the Male Breast, 464
- GILLETTE, WILLIAM J, Ligation of the Left Common Iliac Artery, 22
- GILLIAM, Text-book of Practical Gynæcology, Review of, 953
- Gonococcus Peritonitis, 924
- Gonorrhœal Epididymitis, Acute, Operative Treatment of, 876
- GOODRICH, CHARLES H, Appendicitis and Tetany, 859
- GRAY, H TYRRELL, Invagination of Meckel's Diverticulum, 801
- GREENE-BROOKS, Diseases of the Genito-urinary Organs and the Kidneys, Review of, 317
- Gritti's Amputation, with Nerve-blocking and Regional Anæsthesia, 903, Gunshot Injury of the Left Hypoglossal Nerve, 155
- Gunshot Wound of Abdomen, Involving Stomach and Jejunum, Complicated with Pregnancy, 857
- Gynæcology, Text-book of Practical, by D Tod Gilliam, Review of, 953
- H
- HABHEGGER, C J, Skin-grafting of the Heel with Flap from Opposite Thigh, 909
- Hæmatogenous Infection, Acute, of One Kidney in Persons Apparently well, 680
- Hæmaturia as a Complicating Factor in Appendicitis, 388, Symptomless, 237
- Hæmophilia Treated by Transfusion, 625
- HAGNER, FRANCIS R, Symptomless Hæmaturia, 237, Further Reports of the Operative Treatment of Acute Gonorrhœal Epididymitis, 876
- HALPENNY, J, A Method to Facilitate the Avoidance of Infection during Intestinal Anastomosis, Preliminary Report, 554
- HAMMOND, LEVI J, Primary Carcinoma of the Vermiform Appendix, 192
- Hand, Some Deformities of the, 915
- HARRIGAN, ANTHONY HAPT, Fracture of the Os Magnum, 917
- HARTE, RICHARD H, Treatment of Fractures of the Femur, 791, Use of Chloride of Ethyl as a General Anæsthetic, 796
- HARTWELL, JOHN A, The Question of Operation for Non-penetrating Intracranial Trauma, 25, Resection of Tuberculous Elbow, 454, Old Fracture of Patella Lengthening of Quadriceps, 455, Bilateral Nephrotomy for Nephrolithiasis, 457, 460, Cholangitis Due to Colon Bacillus Infection, 922, Gonococcus Peritonitis, 924, Perforated Gastric Ulcer, 926
- HASBROUCK, EDWIN M, Enormous Endotheliomatous Cyst of the Great Omentum, 206
- HAWKES, FORBES, Large Lumbar Hernia Treated by Silver Filagree, 304
- HAYNES, IRVING S, Strangulated Femoral Hernia, Resection of Intestine, 442, Prolapse of Rectum, Bloodless Resection, 443
- HEARN, W JOSEPH, Use of Chloride of Ethyl as a General Anæsthetic, 797
- Heart, Stab-wound of, 138
- Heel, Skin Graft of, with Flap From Opposite Thigh, 909
- HEINE, Die Operationen bei Mittelohreiterungen und Ihren Intrakraniellen Komplikationen, Review of, 941
- Hemorrhage from the Bowel Following Appendectomy, 626, Gastro-intestinal, Following Opera-

- tion for Hernia, 632, Hepatic, Due to Trauma, Arrest of, 541, Traumatic Cerebral, 633; Traumatic Epidural and Cerebral, 122
- Hepatic Flexure, Carcinoma of Rectum Ten Years after Extirpation of Adenoma of, 307
- Hernia, Femoral, Strangulated, 442
- Hernia, Gastro-intestinal Hemorrhage Following Radical Operation for, 632
- Hernia, Inguinal, Undescended Testis Associated with, 321, 467.
- Hernia, Large Lumbar, Treated by Silver Filagree, 304.
- Hernia of the Appendix, Complicated with Appendicitis, 199
- HERZOG, MAXIMILIAN, Contribution to Renal and Ureteral Surgery, 703
- HOTCHKISS, LUCIUS W, Perforating Gastric Ulcer, 132, Typhoid Perforation of the Ileum, 134, Carcinoma of the Cheek, 313, A Method of Operation in Extensive Cancerous Growths of the Cheek Involving the Jaw, 515, Hypertrophic Pyloric Stenosis, 928, Peritonitis with Unknown Site of Infection, 932
- HUBBARD, JOSHUA C, Arteriovenous Anastomosis for Gangrene, 897
- Humerus, Supracondyloid Fracture of, 432
- HUNTINGTON, THOMAS W, The Operative Treatment of Recent Fractures of the Femoral Shaft, 420
- Hydatid Cyst of Liver, Complicating Cholelithiasis, 614
- Hydrocele, Encysted, of the Cord, Resembling Oriental Hernia, 448
- Hydrocele of the Inguinal Canal, Venous Thrombosis and, 247
- Hydronephrosis, Etiology of, 575
- Hypoglossal Nerve, Gunshot Injury of the Left, 155
- Hypophysis, Tumor of the, Removal for Cure of Acromegaly, 781
- I
- Ileum, Typhoid Perforation of the, 133
- Iliac Arteries, Simultaneous Ligation of both External, 872
- Iliac Artery, Ligation of the Left Common, 22
- Infantile Paralysis, Treated by Tendon Transplantation and Nerve Anastomosis, 470
- Inguinal Canal, Venous Thrombosis and Hydrocele of the, 247
- Inguinal Hernia, Undescended Hernia Associated with, 467
- Inguinal Lymph-nodes, Complete Amputation of External Genitals and, 450
- Interlocking Intestinal Suture, 837
- Intestinal Anastomosis, Method to Facilitate the Avoidance of Infection during, 554
- Intestinal Obstruction, Acute, 314
- Intestinal Suture, Interlocking, 837
- Intestine, Resection of, 442
- Intracerebral Hemorrhage, Traumatic, 122
- Intracranial Trauma, Question of Operation for Non-penetrating, 25
- Intraperitoneal Cystotomy, 862
- Intrathoracic Operations in Positive and Negative Atmospheric Pressure, 784
- Ischæmic Paralysis, Volkmann's, 394
- J
- JACOBSON and ROWLANDS, the Operations of Surgery, Review of, 951
- JACOBY, GEORGE W, Craniotomy for Tumor of Acoustic Nerve, 311

- Jaws, Carcinoma of Inner Side of Cheek, Involving Alveolar Process of, 313
- JOHNSON, ALEXANDER B, Gastric Ulcer, 135, Gastro-enterostomy, 136, Appendicitis, Misplaced Appendix, 137, Renal Calculus, 930, Result of Operation for Undescended Testis, 932
- JOHNSTON, GEORGE BEN, Splenectomy, Report of Six Cases, Together with a Statistical Summary of all the Reported Operations up to the Year 1903, 50
- JOPSON, JOHN H, Gunshot Injury of the Left Hypoglossal Nerve, 159, Infantile Paralysis Treated by Tendon Transplantation and Nerve Anastomosis, 475, 476, Hemorrhage from the Bowel Following Appendectomy, 631, Tumors of the Breast in Childhood, 662
- Kidney Surgery, Garre and Ehrhardt's Handbook of, Review of, 944
- KILIANI, O G T, Question of Operation for Non-penetrating Intracranial Trauma, 127, Primary Cancer of the Appendix, 129, Perforating Gastric Ulcer, 132
- Knee, Excision of, 446
- Knee-joint, Fibro-lipoma of Synovial Folds of the, 787.
- Knee-joint, Some Surgical Conditions in the, 714, Fat Tabs of Synovial Membrane, 720
- Knee, Strain-fractures of the, 117
- Knee, Suppurative Arthritis of the, 467
- Kriegssanitätswesens in Russisch-Japanischem Kriege, 1904-1905, by Dr Walter von Oettingen, Review of, 947

K

- KAMMERER, F, Benign Stricture of the Oesophagus, Gastrostomy, Dilatation by the String Method, 147, Acute Intestinal Obstruction, 314, Backward Dislocation of the Elbow, Ulnar Paralysis, 621
- KEENAN, C B, Primary Carcinoma of the Appendix, 560
- Kidney, Acute Hæmatogenous Infection of one, in persons apparently well, 680
- Kidney and Ureter, Nephrectomy for Tuberculosis of the, 144
- Kidney, Cystic Degeneration of the, 241
- Kidney, Diagnosis and Prognosis of Tuberculous and Septic Conditions of the, 88
- Kidney, Fibrinous Calculi in the, 378
- Kidney-lipoma, 707
- Kidney, Rupture of the, 709
- Kidney Stone, 930

L

- Laminectomy, Reduction of Fracture-dislocation of Spine after, 140
- LANGE, SIDNEY, Strain-fractures of the Knee, 117
- Laparotomy, After-treatment, Early Rising in the, 774
- LE CONTE, ROBERT G, Resection of Spinal Accessory Nerve for Torticollis, 152
- LEE, H M, Gunshot Wound of Abdomen Involving the Stomach and Jejunum, Complicated with Pregnancy, 857
- LEE, W ESTELL, Gastro-intestinal Hemorrhage Following Radical Operation for Hernia, 632, Use of Ethyl Chloride as a General Anæsthetic at the Pennsylvania Hospital, 641, 795
- Leg, Amputation of Lower End of, for Exostosis, 624
- LILIENTHAL, HOWARD, Carcinoma of Rectum Ten Years after Ex-

- tirpation of Adenoma of Hepatic Flexure, 307, Perforating Duodenal Ulcer, 463; Carcinoma of the Male Breast, 465, Traumatic Aphasia from Contre Coup, 612, Suppurating Hydatid Liver Cyst Complicating Cholelithiasis, 614
 Lipoma of Kidney, 707
 Liver, Hemorrhage from, due to Trauma, Arrest of, 541, Note on Syphilis of the, 186
 LOBINGIER, ANDREW STEWART, Gangrene of the Gall-bladder, 72
 LOUX, R. HIRAM, Ureterostomy and Nephrostomy for Hydronephrosis, 314.
 Ludwig's Angina, Report of Five Cases of, 649, 788
 LUSK, WM C, Reduction of Supracondyloid Fracture of the Femoral Shaft, 432
 Lymph-nodes, Complete Amputation of External Genitals and Inguinal, 450, Technic of Early Operation for the Removal of Tubercular Cervical, 169

M

- MACCLURE, THEODORE R, Silverized Catgut, 769
 MACLAREN, ARCHIBALD, Note on Syphilis of the Liver, 186
 MARTIN, WALTON, Typhoid Perforation of the Ileum, 133
 MASTIN, WM M, Recurrence at a Late Period after Operation for Cancer of the Breast, 527
 MATTHEWS, FRANK S, Fingernucleation of the Tonsil, 883
 MAYO, CHARLES H, The Surgical Treatment of Bunion, 300, Transperitoneal Removal of Tumors of the Bladder, 105
 MAYO-ROBSON and CAMMIDGE on Surgery and Pathology of the Pancreas, Review of, 799

- McCOSH, ANDREW J, Question of Operation for Non-penetrating Intracranial Trauma, 127; Primary Cancer of the Appendix: No Recurrence after Nine Years, 128
 McWILLIAMS, CLARENCE A, Reposition of Abdominal Undescended Testis in Scrotum, Followed by Necrosis, 467, Osteoplastic Closure of Skull Defect, 122, Reduction of Fracture-dislocation of Spine after Laminectomy, 140
 Meckel's Diverticulum, Invagination of, 801.
 MELLER, Ophthalmic Surgery, Review of, 957.
 Mesentery, Chyle Cysts of the, 565.
 Metabolism and Practical Medicine, by Carl von Noorden, Review of, 954
 MEYER and SCHMIEDEN on Bier's Hyperæmic Treatment, Review of, 955
 MEYER, WILLY, Large Lumbar Hernia Treated by Silver Filagree, 304, Craniotomy for Tumor of Acoustic Nerve, 309, 313; Resection of Tuberculous Elbow, 455, Perforating Duodenal Ulcer, 463, Suppurative Tenosynovitis of Flexors of Hand and Wrist, 618; Re-amputation of Lower End of Leg for Exostosis in a Previous Bier Amputation, 624
 MILLER, MORRIS B, Caries Sicca, 151; Removal of the Lingual and Mandibular Nerves by the Twisting Method of Thiersch, 638.
 MITCHELL, CHARLES F, Hemorrhage from the Bowel Following Appendectomy, 626
 MONKS, GEORGE H, Carcinoma of the Appendix Vermiformis, 563.

- MORRIS, ROBERT T, The Serous Coat of Blood-vessels Compared with the Peritoneum, 18
- MOSCHCOWITZ, ALEXIS V, Simultaneous Ligation of both External Iliac Arteries for Secondary Hemorrhage following Bilateral Ureterolithotomy, 872
- Mouth and Tongue, Cancer of the, 481
- Mouth, Carcinoma of Inner Side of Cheek, Involving Floor of, 313
- MULLER, G P, Removal of the Lingual and Mandibular Nerves by the Twisting Method of Thiersch, 639
- Musculo-spiral (Radial) Paralysis Due to Dislocations of the Head of the Radius, 275

N

- Nephrectomy for Tuberculosis of the Kidney and Ureter, 144
- Nephritis, Interstitial, with Multiple Abscess Formation, 148
- Nephrolithiasis, Bilateral Nephrotomy for, 457
- Nephrostomy and Ureterostomy, Synchronous, for Hydronephrosis, 314
- Nephrotomy, Bilateral, for Nephrolithiasis, 457
- Nerve-blocking in the Gritti Amputation, 903
- Nerves, Operation for Old Injury of Forearm, Involving Median and Ulnar Nerves, 451
- Neurectomy, Lingual and Mandibular, 636
- NEWELL, WILLIAM A, The Conservative Treatment of Fractures of the Femur, 748
- New York Surgical Society, Transactions of, 122, 135, 304, 442, 606, 922
- NICHOLSON, CLARENCE M, Cystic Degeneration of the Kidney, 241

- Nierenchirurgie, Handbuch von Garre und Ehrhardt, Review of, 914
- NOOPDEN, CARL VON, Metabolism and Practical Medicine, Review of, 954

O

- Œsophageal Diverticulum, 615
- Œsophagostomy, 530
- Œsophagus, Benign Stricture of the, 146, Resection of Lesser Curvature of Stomach and, 530
- OETTINGEN, WALTER VON, Studien auf dem Gebiete des Kriegssanitätswesens in Russisch-Japanischem Kriege, 1904-1905, Review of, 947
- Omentum, Endotheliomatous Cyst of the, 206
- Operations of Surgery, Jacobson and Rowlands, Review of, 951
- Ophthalmic Surgery, by Dr Josef Meller, Review of, 957
- Orthopædic Surgery, Manual of, by Augustus Thorndike, Review of, 954
- Os Calcis, Non-tuberculous Osteomyelitis of the, 762
- Os Magnum, Fracture of the, 917
- Osteomyelitis, Non-tuberculous, of the Os Calcis, 762
- Osteoplastic Closure of Skull-defect, 122
- Ovary, Sarcoma of the, in a Child, 619

P

- Pædiatrics, The Practice of, Edited by Walter Lester Carr, Review of, 946
- Palate, Carcinoma of Inner Side of Cheek, Involving Hard, 313
- Pancreas, Surgery and Pathology of, Mayo-Robson and P C Cammidge, Review of, 799
- Parathyroid Emulsion, Tetany Following Thyroidectomy Cured by

- the Subcutaneous Injection of, 161
- PARK, Treatise on Surgery, Review of, 936
- Patella, Fracture of the, Arthrotomy for, 718, Dislocation of, 723, Old Fracture of, 455
- PATTERSON, FRANCIS DENISON, Congenital Defect in the Ulna, 296
- PECK, CHARLES H, Perineal Prostatectomy, 306, Ureterostomy and Nephrostomy for Hydronephrosis, 315 Perforating Duodenal Ulcer, 464, Tenosynovitis of Flexors of Hand and Wrist, 617
- PECK, GEORGE, Suppurative Arthritis of the Knee, 467
- Pelvis, Fracture of the, 447
- Penis, Epithelioma of, 449, 450
- Peritoneum, Primary Sarcoma of, 848, Serous Coat of Blood-vessels Compared with the, 18
- Peritonitis, Diffuse, 130, Diffuse Septic, Due to Appendicitis, Results of Treatment of, 828, Gonococcus, 924, in Children from Unknown Sites of Infection, 821, 932
- Philadelphia Academy of Surgery, Transactions of, 151, 470, 625, 787
- Popliteal Aneurysm Presenting Unusual Difficulties in the Matas Operation, 15, Treatment of, by the Reconstructive Method, 1
- Postural Treatment of Diffuse Septic Peritonitis, Results of, 828
- Prevesical Abscess, 224
- PRICE, JR, JOHN W, Ludwig's Angina, Report of Five Cases, 649, 788
- PRINGLE, J HOGARTH, Notes on the Arrest of Hepatic Hemorrhage Due to Trauma, 541
- Prostate, Contribution to the Surgery of the, 266
- Prostatectomy, Perineal, 306, Suprapubic, 624.
- Prostatic Enlargement, Comparative Value of Various Measures for Relief of, 258
- Psoas Abscess, Posterior Operation for Cure of, 788
- Pulmonary Artery, Embolism of Operative Interference in, 772
- Pylorus, Hypertrophic Stenosis of, 928
- R
- Radius, Arrest of Growth at Lower End of, after Separation of its Epiphysis, 115; Musculo-spiral (Radial) Paralysis Due to Dislocations of the Head of the, 275
- RANSOHOFF, J LOUIS, Cause of Sudden Fall in Blood-pressure while Exploring the Common Bile-duct, 550, Venous Thrombosis and Hydrocele of the Inguinal Canal, 247
- Rectum, Carcinoma of, Ten Years after Extirpation of Adenoma of Hepatic Flexure, 307, Carcinoma of the, 610, Excision of Carcinoma of the, 80, Prolapse of, 443
- Renal and Ureteral Surgery, Contribution to, 703
- Renal Calculus, 930
- ROBERTS, JOHN B, Gunshot Injury of the Left Hypoglossal Nerve, 155, Gas-ether Anæsthesia, 477
- RODMAN, WM L, Infantile Paralysis Treated by Tendon Transplantation and Nerve Anastomosis, 476, Gas-ether Anæsthesia, 477
- ROSS, GEORGE G, Subcutaneous Rupture of the Spleen Report of Cases with Remarks, 66, Gas-ether Anæsthesia, 477
- ROYSTER, HUBERT ASHLEY, The Inconsistencies of the Gauze Pack, 219

S

- Sarcoma of Back Cured by Mixed Toxins, 465
- SCHACHNER, AUGUST, Comparative Value of Various Measures for Relief of Prostatic Enlargement, 258
- SCUDDER, CHARLES L., Arthroplasty for Complete Ankylosis of Elbow, 711, Harrington's Operation of Intraperitoneal Cystotomy, 862
- SEELIG, M. G., Hæmaturia as a Complicating Factor in Appendicitis, 388
- Semilunar Cartilages of Knee-joint, Dislocation of, 726
- SHELDON, JOHN G., Non-tuberculous Osteomyelitis of the Os Calcis, 762
- Silver Filagree, Lumbar Hernia Treated by, 304
- Silverized Catgut, 769
- Skin-grafting of the Heel with Flap from Opposite Thigh, 909
- Skull, Cerebral Injury Due to Depressed Fracture of the, 125; Fractured, with Extradural Hemorrhage, 125
- Skull-defect, Osteoplastic Closure of, 122
- SOBOTTA, Atlas and Text-book of Human Anatomy, Volume III, Review of, 318
- SPEESE, JOHN, Tumors of the Breast in Childhood, 662
- SPELLISSY, J. M., Removal of the Lingual and Mandibular Nerves by the Twisting Method of Thiersch, 639
- Spermatic Cord, Encysted Hydrocele of the, 448
- Spinal Accessory Nerve, Resection of, for Torticollis, 152
- Spine, Blastomycosis of the, 889, Reduction of Fracture-dislocation of, after Laminectomy, 140
- Spleen, Subcutaneous Rupture of the, 66, 152
- Splenectomy, 50
- STARR, F. N. G., Operation for Undescended Testicle, 351
- STETLEN, DR. WITT, Musculo-spiral (Radial) Paralysis Due to Dislocations of the Head of the Radius, 275
- STEWART, F. T., End-to-End Anastomosis of the Brachial Artery, 152
- STEWART, GEORGE D., Nephrectomy for Tuberculosis of the Kidney and Ureter, 144, Benign Stricture of the Œsophagus, Gastrotomy, Dilatation by the String Method, 146, Volkmann's Ischiæmic Paralysis, 606, Primary Sarcoma of the Appendix, 607, Carcinoma of Rectum, 610
- STIMSON, A Treatise on Fractures and Dislocations, Review of, 319
- Stomach, Acute Dilatation of, Complicating Typhoid Fever, 678, Carcinoma of removed by partial Gastrectomy, 444, Diaphanoscopy of the, 785, and Œsophagus, Resection of Lesser Curvature of, 530, Gunshot Wound of, 857, Hypertrophic Pyloric Stenosis, 928, Perforating Ulcer of, 620, 926
- STONE, HARVEY B., Desmoid Tumors of the Abdominal Wall, 175
- Surgery, Park's Treatise on, Review of, 936, Wyeth's Treatise on, Review of, 939
- Suture, Interlocking Intestinal, 837
- SWINBURNE, GEORGE K., Disturbances Due to Disease of the Verumontanum and its Treatment with the Posterior Urethroscope, 369
- Synovial Fibro-lipoma of the Knee-joint, 787
- Syphilis of the Liver, Note on, 186

T

- Talipes Valgus, Tendon Transplantation for, 788
- TAYLOR, ALFRED S, Volkmann's Ischæmic Paralysis, 394, 453
- Tendon Transplantation for Talipes Valgus, 788
- TENNEY, BENJAMIN, Some Surgical Conditions in the Knee-joint, 714
- Tenosynovitis of Wrist, 617
- Testis, Undescended or Mal descended, Associated with Inguinal Hernia, Treatment of, 321; Associated with Inguinal Hernia, Reposition followed by Necrosis, 467, Result of Operation for, 351, 932
- Tetany Following Thyroidectomy Cured by the Subcutaneous Injection of Parathyroid Emulsion, 161, with Appendicitis, 859
- Thiersch's Twisting Method in Neurectomy, 636
- THOMAS, T TURNER, Ludwig's Angina, 788
- Thoracotomy, 138
- Thorax, Operations Involving the Cavity of the, in Positive and Negative Atmospheric Pressure, 784
- Thorndike's Manual of Orthopædic Surgery, Review of, 954
- Thrombosis, Venous, and Hydrocele of the Inguinal Canal, 247
- Thyroid Gland Transplantations, Technic of, 777
- Thyroidectomy, Tetany Following, Cured by the Subcutaneous Injection of Parathyroid Emulsion, 161
- TILTON, B T, Gastro-enterostomy, 136
- Tongue, Cancer of the Mouth and, 481
- Tonsil, Finger-enucleation of the, 883

- Torticollis, Resection of Spinal Accessory Nerve for, 152
- Transfusion, Hæmophilia Treated by, 625
- Trauma, Question of Operation for Non-penetrating Intracranial, 25
- Tubercular Cervical Lymph-nodes, Technic of Early Operation for the Removal of, 169
- Tuberculosis of Elbow, Resection for, 454
- Tuberculosis of the Kidney and Ureter, Nephrectomy for, 144
- Tuberculous and Septic Conditions of the Kidney, Diagnosis and Prognosis of, 88
- TURCK, RAYMOND CUSTER, The Interlocking Suture, 837
- Typhoid Fever Complicated by Acute Dilatation of the Stomach, 678
- Typhoid Perforation of the Ileum, 133

U

- Ulna, Congenital Defect in the, 296
- Ulnar Nerve, Recurrent Dislocation of the, 409
- Ulnar Paralysis Complicating Dislocation of Elbow, 621
- Ureter, Nephrectomy for Tuberculosis of the Kidney and, 144
- Ureteral Calculi, Multiple, with Hypoplasia of Opposite Kidney, 703
- Ureteral Calculus, 445
- Ureterolithotomy, Bilateral, Followed by Secondary Hemorrhage Requiring Simultaneous Ligature of both External Iliac Arteries, 872
- Ureterostomy and Nephrostomy, Synchronous, for Hydronephrosis, 314
- Urethra, Rupture and Laceration of the, 447

Urethroscope, Diseases of the Verumontanum Treated with the Posterior, 369

Uterus, Adenomyoma of, by Thomas S Cullen, Review of, 958

V

VAN KAATHOVEN, J J A, Twenty-five Hundred Cases of Gas-ether Anæsthesia without Complication, 435, 480

Vas Deferens, Method of Anastomosing When Divided, 793

Verumontanum, Treatment of Disease of the, with the Posterior Urethroscope, 369

Volkmann's Ischæmic Paralysis, 394, 606

W

WAECHLER, ADOLPH, Arrest of Growth at the Lower End of the Radius after Separation of its Epiphysis, 115

WAINWRIGHT, JONATHAN M, Modification of the Gritti Amputation with Special Reference to Nerve-blocking and Regional Anæsthesia, 903

WALKER, JOHN E, Peritonitis in Children with Unknown Site of Infection, 934, Undescended Testis Associated with Inguinal Hernia, 467, Treatment of Undescended or Maldescended Testis, 468

WARREN, J COLLINS, Cancer of the Mouth and Tongue, 481

WHITE, C Y, Tumors of the Breast in Childhood, 662

WHITMAN, ROYAL, Excision of Knee, 446, Operative Treatment of Coxa Vara, 446; Fracture of the Neck of the Femur, 447

WIFNER, JOSEPH, Osteoplastic Resection of the Costal Arch, Followed by Resection of Lesser Curvature of Stomach and Œsophagus, and Œsophagostomy, 530

WILLIS, MURAT, Treatment of the Appendix Stump after Appendectomy, 74

WILSON, CUNNINGHAM, Acute Dilatation of the Stomach Complicating Typhoid Fever, 678

Women, The Diagnosis and Treatment of Diseases of, by H S Crossen, Review of, 950

WOOD, FRANCIS CARTER, Blastomycosis of the Spine, 889

WOOLSEY, GEORGE, Excision of Carcinoma of the Rectum by the Combined Method, 149, Interstitial Nephritis with Multiple Abscess Formation, 148, Reduction of Fracture-dislocation of Spine after Laminectomy, 140, Craniotomy for Tumor of Acoustic Nerve, 310, Partial Gastrectomy for Unusually Situated Cancer, without Obstruction, 444

WYETH, Treatise on Surgery, Review of, 939

Y

YOUNG, JAMES K, Fibro-lipoma of Synovial Folds of the Knee-joint, 787, Tendon Transplantation for Talipes Valgus, 788, Psoas Abscess, 788

